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ABSTRACT

This report is based on contributions to two workshops arranged jointly by Task Force Human Resources and the DELTA (Developing European Learning through Technological Advance) Unit. The purpose of collecting these papers was to provide an overview of the implications of the DELTA Exploratory Action outcomes for future research. After the preface by Roland Huber and an introduction by Morten Moller, the following papers are presented: (1) "Community Policy in Distance Training and Education" (Hywel C. Jones); (2) "Telematic Services for Education in the Context of the New Framework Programme for Research and Development" (Joan Majo); (3) "Community Actions and Priorities in Open and Distance Education and Training--Distance Learning Initiatives" (R. Charters d'Azavedo); (4) "Rationale for a Telematic Infrastructure for Distance and Flexible Learning (Electronic Universities)" (Luis Rosello); (5) "Towards the European Electronic University" (Rhys Gwyn); (6) "Developing Acceptance--How Can Integrated Systems Be Used for Industry-Oriented Distance Education and Training?" (Soren Nipper); (7) "Course Delivery and Student Support Systems for Distance Teaching and Training" (F. H. D. Gastkemper); (8) "Introduction to JANUS" (Paul Bacsich); (9) "DEDICATED--Development of a New Dimension in European Computer-Aided Teaching and Education" (J. Encarnacao, M. Gunther, Ch. Hornung, A. Knierriem. and H. Kuhlmann); (10) "Overview of the Camce Communication System: A Potential Communication Framework Supporting Multimedia Courseware Development Process in a Distributed Environment" (Marco Carosi and Francesco Feliciani); (11) "The Need for Large Scale Experiments in Flexible Learning" (Pierre Landry); (12) "Remote Training Services: A Medium-Term View" (Richard Walker); and (13) "Evaluation and Assessment Strategies for Pilot Experiments" (Chris Curran and Ann Wickham). (DB)

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Telematic Infrastructures for Flexible and Distance Learning
'Electronic Universities'

Edited by Morten Møller and Haydn Shaughnessy

April 1991

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This report is based on contributions to a workshop arranged jointly by Task Force Human Resources and the DELTA Unit of DG XIII/F in October 1990 on the topic "Telematic Networks for Distance Education and Training, 'Electronic Universities' and on presentations given at a DELTA workshop in November on future research topics in the area of Learning Technology. Some of the papers have been extended in order to provide a fuller picture of current issues for those who were unable to attend this workshop.

The overall aim in collecting these papers is to provide, within the context of the Community Actions in the field of technology research and open and distance learning, an overview of the main implications of the outcome of the DELTA Exploratory Action for future research in the area of telematic systems for flexible and distance learning and for the implementation of a European-wide advanced infrastructure for the conveyance of education and training.

Thanks are due to the authors, the Task Forces for Human Resources, and the DELTA team. The support of Anne Marie Fynbo and Alan Huyton in arranging the workshop are especially acknowledged.

Preface: New Directions in Flexible Learning

Roland Hüber, Director DGXIII/F

The creation of the "information society", where information-flow replaces manual labour as a key element of profitability, was first predicted as long ago as the early 1960s. Europe, today, is at the beginning rather than the end of this long term transition. Over the next five years, technological progress, economic integration and the internationalisation of the economy, will all proceed at an accelerated pace and the true depth and complexity of an information-led economy will become apparent.

Underlying the transition to the information society is a technological transformation in telecommunications. Improvements to the existing telecommunications infrastructure and the evolution towards broadband telecommunications are creating the means to expand exponentially the volume and variety of information which businesses and individuals can exchange.

These changes make new and extraordinary demands on the resources of individuals at work. It is recognised in most advanced countries today that the quality of human resources is now a key competitive factor. Not only does this mean that Europe must develop its human resources in new and innovative ways, it must do so also with an eye on how its competitors are investing in, and harnessing, human skills.

The technological changes underpinning the modern economy can only progress if the skills are in place to make new technologies work. But technological innovation demands faster and more frequent skills updating. This is the real human resource challenge of the future.

The DELTA Programme (Development of European Learning Through Technological Advance) was an Exploratory Action designed to investigate ways in which Europe could meet the need for greater flexibility in skills training and education through the use of advanced technologies. In a series of workshops held at the latter part of DELTA's exploratory phase this theme was explored along a number of dimensions. Could there, for example be an electronic infrastructure - a kind of electronic open university - which would allow people to access skills updating when and where it was needed?

Such an infrastructure would pose daunting technological and human problems but it might also be just the kind of vision with the right innovative force to bring about the necessary revolution in training supply.

But what would be the acceptance in the market place of new training systems? Are courseware producers sufficiently aware of the technologies which can improve their work and reduce the cost of their products? Can advances in artificial intelligence help bridge the gap between the need for training and the limited supply of trainers? How are users going to react to these new systems?

Many such questions were addressed by the DELTA Consultation Workshops. The workshops were designed to allow actors in this sector to make an open and public contribution to the future of DELTA's work.

The current dossier is a resume of a workshop which focussed its attention on the idea of the electronic infrastructure for training. The contributions from all the authors are gratefully acknowledged. They each represent detailed thinking on specific parts of the training problem. As a whole, this dossier therefore marks an important step in the realisation of new, innovative training systems for the single European market and beyond.

Introduction

Morten Møller, DGXIII/F

Training - or the more grandly titled "human resource development" - is at the top of the political agenda in the European Community. New flexible learning systems have long offered the prospect of creating radical reductions in the cost of training. In Mr Hüber's preface to this edition and in many of the articles which follow there are repeated references to the desirability of bringing training costs down. The simple reason for this is the perceived need for a dramatic increase in the amount of training that any one individual must undertake if he or she is to play a full part in Europe's economic future.

Additional training is essential in the new economic environment of the 1990s and beyond. But added to that is the training burden brought upon us by the completion of the single European market. The single market has a short and a long term impact on training. In the first instance there are new standards and procedures arising out of the Single European Act. In the long run there will be more varied and costly learning burdens. As the community develops there will be a need for more harmonised arrangements in, for example, banking, social security, medical care, transport, customs and other official procedures. Each implies that people will have to learn to do things differently and often in a different language.

Europe faces then the twin challenges of human resource development as an instrument of international competitiveness and human resource development for the single market.

The Community is running a number of training related programmes through its Task Force in Human Resources to help meet these challenges. But it is clear that the problem itself cannot be solved simply by spending money on it. One estimate is that each individual's training load will have to expand fourfold in the coming decades. It is un-imagineable that current expenditure on training will increase by this proportion. And that is why the Community has sponsored the DELTA Programme. One of DELTA's primary objectives is to investigate ways in which technology can help large scale training take place in the most cost effective manner possible.

It has been suggested, based on the examples of the European Open Universities, that Europe's training problems can be resolved through "distant" or "flexible" training systems in which tutor and trainee rarely meet. The technology for remote learning exists and it has been shown to be effective in national environments. It has however been a more costly exercise than many would have wished. So although it works, it is still expensive to run.

The more important question is whether some form of Open University could operate effectively on a Community-wide scale. This problem is at present being investigated in the Task Force Human Resources with the help of panels of member state experts. These Community initiatives are discussed, in contributions to this collection, from members of the Task Force in Human Resources: Hywel Jones, the Task Force Director, and R. Charters D'Azavedo, Head of Division, Distance Learning Initiatives.

The rest of the papers are more concerned with the technological infrastructure which might support any form of cost effective training.

If you take the proposition - there should be a European Open University - you then have to ask what technologies would underpin it. And you have to ask whether those technologies would provide a safe and supportive environment in which to run effective learning courses. Given the level of training now needed you must also ask if the model can prove cost effective, i.e. provide training at much lower unit cost than is now possible.

When one refers to a learning situation as "cost effective" there are of course a number of hidden ambiguities. Are we referring simply to a cheap form of learning with little regard for its pedagogic effectiveness? Or are we sincerely saying that cost effective remote learning can also be pedagogically effective? Is there of necessity a trade-off between pedagogic effect and lower costs?

Little attempt has been made to treat the problem of evaluation in a systematic enough manner to allow us to answer these questions. But as the DELTA programme has progressed the need for a better understanding of cost versus effect has become more pressing.

The papers in this volume attempt to provide preliminary answers to all these questions.

In the opening paper Joan Majó gives an overall view of the political thinking behind DELTA and other R & D related Community programmes. It is

important for the reader to understand the long term shifts in the political priorities that lie behind current policies and Mr Majó refers to four dimensions along which current policy can be understood.

His article is underlined by contributions from members of the Task Force in Human Resources, Hywel Jones and Charters D'Azavedo. Both articles underline the importance now being attached to continuing, indeed lifelong training within the Community. The Community's commitment to lifelong training begs in Mr Jones words the question "What can we expect from distance learning technology in terms of lower unit costs for hardware and software so that new tools and techniques can be more accessible throughout the system?"

The following articles attempt to answer that question. Luis Roselló, head of the DELTA Unit, gives his account of a Telematic Infrastructure for Distance and Flexible Learning, emphasising the range of initiatives which already exist in distance learning and the need to find ways of giving technical support to facilitate greater efficiency and wider student reach for those institutions. Mr Roselló emphasises in particular the need to "form a basis to support existing networks in order to facilitate both interoperability amongst them and portability of the courses developed".

Making better use of existing resources is a theme of many of the papers in this volume, though there is also continuing reference to innovation. The theme of innovation and continuity is taken up by Søren Nipper and Rhys Gwyn.

Søren Nipper from EuroPACE, highlights the fact, based on the experience of EuroPACE, that the main problem so far in distance learning has arisen not out of the technology, but out of user acceptance. The technology is available and workable. What we need are pilot projects which integrate new learning media in a way that is acceptable to the users.

In a separate article Rhys Gwyn stresses that universities traditionally were institutions which supported the learning process whilst leaving individual colleges to get on with the business of teaching. In other words universities provide the infrastructures within which tutors and learners can work. Could an electronic infrastructure act as the university of the future, providing all the necessary electronic links to make distance learning effective and indeed enjoyable?

The possibility has been talked about frequently but nobody has yet sat down to work out what the practical, and often mundane, implications are of implementing an electronic university. Mr Gwyn's paper is a first approach to that difficult subject.

Within any distance learning project student support is a primary concern. Indeed distance and flexible learning succeeds or fails according to how well its students are supported. In the attempt to reduce the cost of learning we must also attempt to improve the quality of student support. These are potentially contradictory requirements but the contradictions which must be faced and overcome. An article by Mr Gastkemper, therefore, looks at telematics networks as elements of educational as opposed to information technology - ie at their validity in pedagogical situations rather than their efficacy as information processing mechanisms.

The JANUS Project is an attempt by the existing distance teaching universities to specify the requirements for a European Electronic University - or at least the rudiments of an electronic network which would vastly improve their work and their ability to collaborate across national boundaries. In an article by Paul Bacsich the JANUS concept is explained and its ambitions outlined.

A problem for JANUS and any other collaborative network is how to move from simple voice or data communications to international collaborative authoring in a multimedia environment. The issues raised by the transition to multimedia and international collaboration are tackled in an article on the DELTA project, CAMCE, by Marco Carosi and Francesco Feliciani.

Technology based distance and flexible learning is however not only a matter for distance teaching universities. In their article presenting the DEDICATED project, Professor Encarnacao and his colleagues outline a network architecture for other institutions which want to undertake cooperative research and teaching. The approach advocated is to begin now with pilot testing on state of the art technology and to research more advanced possibilities which will be available in the near future.

Finally we move on to the problems of getting remotely produced and collaboratively designed educational products into the market place. A controversial opinion from Richard Walker of DELTA's EPOS project is that there might well be a large scale rejection of DELTA-type learning products by the market. His article is worth reading as a reminder that the technology push of DELTA has still to accommodate the peculiarities of individual learning experiences.

To complement Mr Walker's article Mr. Pierre Landry gives an outline of changes in management approach needed in large companies if educational technology is going to take off on a larger scale.

And if new learning products do reach the market in the coming years and find some degree of acceptance, how do we evaluate their effectiveness? Evaluation takes us back to the very beginning of this introduction and the purpose of the conference on which it was based. Just how can new forms of training be evaluated? How can the objective of low cost be reconciled with high quality learning? Are their ways of measuring the relationship between the two?

Chris Curran and Ann Wickham approach this problem in the final contribution to this collection. It is not easy to build a case for an effective evaluation procedure. Like many of the aspects of new training techniques touched upon in this volume, the process of trial and error will reveal as much about the road to success as will any amount of a priori theorising. The most beneficial aspect of the DELTA programme however is that it has finally given pedagogists the opportunity to test the theory - that large scale collaboration in authoring and in learning can be cost effective and of great pedagogic value.

Over the next four years in the second phase of DELTA the theory will be put to the test in a number of large scale projects sponsored by the European Community. The following papers intend to provide a possible context for how these developments can be brought into a broader context by including them in a future telematic infrastructure for flexible and distance learning or, in other words, a European Electronic University.

Community Policy in Distance Training and Education

Hywel C. Jones, Director, Task Force Human Resources.

Introduction

I would like to begin by outlining where we are in the debate over higher education and training strategy in the development of the Community, and to set a little bit of the context, as I see it, in which the discussion about the role of telematics services in training is taking place.

The first point is that over the last two years it has been clear that, because of 1992 and the pressures of achieving the single market, education and training have moved very much to the centre of the stage in broad policy considerations at the Community level.

The position has accelerated considerably and interest in education and training, human resource development, have been further intensified by the impact of external events over the last year, particularly those in Central and Eastern Europe. Education and training is one of the key priorities in the development support programmes agreed with Central and Eastern European countries. PHARE is one example. It started its work with Poland and Hungary and now involves a number of other countries, notably Czechoslovakia in this phase.

So we are living under the pressure of a double dynamic, the 1992 dynamic now overtaken by the external events taking place in Central and Eastern Europe. Indeed it is not just Central and Eastern Europe. We are heavily involved in discussions with the EFTA countries about relations with Scandinavia, Austria and Switzerland. We have opened up COMETT II to the EFTA countries. We are now involved in negotiations about whether they should come into ERASMUS. And we have just started for the first time, as a result of the Delors - Bush dialogue, a point in the discussion on training where we will be holding series of meetings in Washington particularly about University/Industry cooperation and the need to master technological change. This will allow us to learn from strategies that the Americans have been developing over recent years.

Consolidation and Progress

Internally, in the Task Force Human Resources, our work continues to broaden in range and content, particularly with the preparation of a two part strategy paper, which will have to go to the Council of Ministers and the European Parliament. The first part will be an attempt at a fresh analysis on projected skill needs, Community-wide, and skill deficits for the remainder of this century. Part two will be: what should the education and training response be to these deficits? Specifically, how should the training systems respond within the framework of the Community under Article 128 in the Treaty, which gives us the responsibility to promote a common training policy in order to ensure that we meet the challenges of the future.

The two part paper is in the pipeline now, and there are several stages leading up to the production of it. In that context there is no doubt about the centre-piece of the strategy for the 1990s. The Commission has already made it clear. There has to be a much more substantial push on continuing education and training throughout life in the workforce. This includes those out of work as well as those in. That's why in May this year, the Council adopted the FORCE programme, which together with Eurotecnet, represents a substantial joint effort to look at the issues involved in access to and participation in continuing training. This issue is also one of the central elements in the European Charter of Social Rights adopted by 11 of the 12 Heads of State. The Charter of Social Rights establishes an entitlement to training for every worker. The point is at the heart of what we call the social dialogue, namely the discussions between employers and trade unions at the highest level. We are now at a very advanced stage in our discussions on this subject. It is a controversial issue because it raises the whole question of the financing of training and the need for a new partnership, a new deal in my language, between the public and the private sectors in the training business.

In looking at this deal between the public and private sector and reflecting on the use of technology and the relationship of technology to the reform and adaptation of the education and training systems, I think the concept of partnership is a very important one to have in the back of one's mind.

The other aspect of this, and this flows from the Treaty itself, reinforced by the new European Act of 1987, is our commitment to enabling the free movement of persons. This also makes heavy demands on the training system. It requires us to develop joint and mutual accreditation systems

rapidly.

We are in fact moving more and more to a European market place of qualifications. We have two directives to foster this. The first one, already agreed, is the mutual recognition of qualifications for access to regulated professions where the professional studies have involved more than three years of higher education learning. This will soon be complemented by a second directive for all studies of less than three years. As these Directives come into effect, we can see a huge interest in this area. Just look at the daily papers to see the job advertisements where the European profile has become much higher over the last even 18 months than it ever was before. People are looking for this European dimension to qualifications.

Alongside these initiatives in training strategy we are going to try to put to Council a paper that looks at the strategic questions facing the higher education and university systems. In November we will be holding in Sienna - on the 750 anniversary of the University of Sienna - the first meeting of Ministers responsible for universities. With the help of a team of experts we have produced a report which looks beyond 1993 at where higher education might be going up to the end of the century, especially taking into account the impact of 1992. In that paper you will not be surprised to see a section on the potential of open and distance learning.

In looking to the future, distance and open learning clearly has a major role to play. Community strategy, however, has to forge better links between the investment in training and investment in R & D. Investment in R & D without a substantial accompanying investment in training and skills transfer is a missed opportunity. It is crucial to get the results of R & D back into enterprises to make European companies much more competitive, and I believe myself, that open and distance learning could be a vital part of that process. We need to be thinking about this much more carefully.

The first wave of projects under COMETT II is beginning to yield the elements of a critical mass of operations involving open and distance learning and new technology. We are going to put a lot of effort inside the Commission in the next phase of COMETT into evaluation. The Commission is making a priority of evaluation because we believe it is right and proper that we should proceed to a very careful evaluation and monitoring of what we are doing. In the next phase we may well benefit from sharing our thoughts on evaluation with DG XIII, who will also at this stage be evaluating their technology development programmes. Between the two of us, out of our experience of programmes in training and technology, there must come new insights and new methods for deploying technology effectively.

I touched earlier on the European qualifications market place. Let me just say a related word on that very briefly. By the next academic year we will have awarded 35.000 students scholarships under the Erasmus scheme. We have almost a half of the 3.500 institutions of higher education on the territory of the Community, not including the DDR, involved in ERASMUS. But it is still a drop in the ocean, only 4 - 5 % of the total student population is involved in structured exchanges between institutions of education. The nasty question that I think we must ask ourselves in the Commission and which the Ministers of Education must ask themselves and certainly the universities are asking themselves is: What about the other 95%?

If the Europeanisation of studies is henceforth necessary for the future curriculum vitae of each and every person in a single market, can we be satisfied with the fact that we have a wonderful ERASMUS programme, but still exclude 95% of the student population? On the contrary. We have to make more effort, and the responsibility for this is ours. I believe that we have to move the European dimension to people and not expect that all people are going to move for us. In this context the distance and open learning technologies have a crucial role to play.

I also want to underline the importance we are attaching to the LINGUA programme, which started to roll in January 1991. I am persuaded that here again the open and distance learning dimension is a crucial one.

Concluding Remarks.

I have mentioned a number of our obligations for 1991, There is another one: We were committed by the Council of Educational Ministers at their meeting in May 1990 to have meetings with national experts and to build up a comprehensive picture of the current situation in distance education and training in the Member States, so that next year we could come back with appropriate proposals for the future. The process of discussion in which we are engaged now with DG XIII is certainly, for the Task Force, a vital part of that development. I think we have got to be very careful about how we move forward in this.

First of all it is quite clear that there is a diversity

of education and training systems and structures in the Community. There is a huge diversity in terms of previous investment and know-how. The Member States are not all starting on an equal footing. I think we have got therefore to think carefully about how we come to terms with this diversity using it as a rich asset but having a degree of realism also about how we move forward. That is something that needs to be done with a degree of sensitivity, and this is not only obviously a question of terminology. It is much more profound than that in my view.

And secondly I think at least in my understanding going way back to when I was involved a bit in the lead up to the British Open University, we have to look at the potential of open and distance learning in terms of the quality and quantity of the trainers, teachers, and counsellors at the grass roots level, because I do not believe that there will be a break through in the centralised production and delivery of high quality materials, giving a critical-mass of economic savings, unless that is accompanied by high quality support at the local delivery point. If I put it in non-controversial language, I think a technology-led approach would be counterproductive unless from the outset it is clear that it is embedded in a strategy that takes account of these factors at the local level. That is not an easy issue with demographic change in particular affecting the scene in the 1990s and an ageing teaching force and little new blood coming into it.

Thirdly I think one must be careful to avoid the impression that what we are trying to promote or propose is the creation of a single institution for distance training and education in the Community. We have 3.500 institutions of higher education. We have even more in further education and in training organisations. We have huge potential, I mentioned earlier in the private sector. I think we have to look at the mechanisms available for linking these different infrastructures. Networking for me is the key.

Having said that networking is the key, there are two outstanding issues, in my opinion.

What can we expect from distance learning technology in terms of much lower unit costs for hardware and software, so that the new tools and techniques can be more accessible throughout the whole system?

And secondly: How can we ensure transferability, both in terms of software and hardware so that we can ensure that the potential of technology is realised out there where it matters - at the grass roots level?

I have outlined for you how we are moving in the development of our strategy, the priorities which the Community attaches to different categories of training. What we are looking for, in order to complete our tasks successfully, is for new technologies to be available and cost-effective. I have voiced some of our concerns about new technology and I hope the Community R&D initiatives in this domain can respond creatively to those concerns. This, when all said and done, is the type of dialogue we need in order to realise the objective of an integrated Europe.

Telematic Services for Education in the context of the new Framework Programme for Research and Development.

Joan Majó (Conseiller Hors Classe, DG XIII)

I would like to focus in this paper on the role and the possibilities that new technological developments offer in training and education. In particular I would like to focus on the position of training and educational technologies within the Third Framework Programme, which was adopted by the Council of Ministers this spring.

DELTA was an initiative in the 2nd Framework Programme, and is now embedded in "Telematics of General Interest" or "European Networks" which is one of the key lines of the 3rd Framework Programme. There is some shift, here, in the orientation of research activities in the Community in relation to the previous Framework Programme and I would like to outline for you some of the political thinking behind this change

There are four different dimensions to it.

1. All the initiatives in the technology research and development area began at the Community level 12 to 15 years ago in response to a need, in the late 70s or early 80s, to increase the competitiveness of European industry.

That was one of the goals of the First and Second Framework Programmes. It was an important and necessary activity in Europe. European industry was in a difficult situation. There was a clear lack of international competitiveness and it was clear that one of the reasons for this was a shortfall in technology research and a growing technology dependency. There was also great duplication of effort between Member States.

During the 1980's a lot of work was done to rectify this, work that is now considered a success. Moving on from this I would like to stress that the final goal of technology development is not the competitiveness of industry. The only acceptable goal for technological development is the improved welfare of European citizens and an increase in their quality of life.

Even though this can be achieved if technology brings us greater competitiveness, we do not need to think of an improvement in the quality of life as an indirect benefit. Technology can be applied directly to the problems that citizens feel and experience.

Many of us are convinced that the main problems people have are: access to information, health care, environmental conditions, saving of energy, mobility of the people. All those problems can be better addressed and better solved by using the new tools that technological development has put in our hands.

Because of this there is a clear shift in the orientation of the Framework Programme in order to focus more directly on the personal needs of citizens. And because of this I repeat: the technological tools that are needed for solving the problems in the sectors, environment, health care, learning etc., are one of the key priorities in the new Framework Programme.

2. The second point refers to what I will call the actual ambience in the Community. We are all now living at the beginning of the period of integration. Integration is a political goal. The single market is a goal that is always in front of us. We are doing a lot of work to reduce barriers to the mobility of goods, services, capital, and labour in Europe. But we need to stress that the single market is not a goal that can be considered as an end in itself. We need to go far beyond this and recognise that what is more important is not just the mobility of the goods, workers, capital etc... The really important point is the mobility of citizens in many other aspects not directly related to his or her role as a worker.

Up to now many more measures have been taken to solve the problems of mobility goods, workers, capital etc, than have been invested in solving the problems of mobility in its various social aspects. We will find, two to three years from now, that when a European citizen moves around the Community all the problems relating to his or her labour are solved, but that lots of problems not directly related to his or her dimension as a worker remain unsolved. Because of this, we need to develop as many as possible of the tools that can represent real help in increasing social mobility.

We need to do this in order to build a single living space, not just a unified market. And a lot of the political emphasis inside the Framework Programme is placed on applying the technologies to satisfy that kind of goal.

3. We need to use technology to increase cohesion, to put together and to balance as much as possible different European areas. We need to give priority to developments which can be useful

in establishing a better, closer link between different European areas. This can of course be done by means of developing physical infrastructures in communication, in roads, in railways, and energy.

But just as important as physical infrastructures are the human and intellectual networks. We need therefore to increase not just the telecommunications networks, but also the information structure, information services and knowledge. Everything that really represents, I repeat once more, that the Community is not only an economic community. It is a Community of living people, that all share the same situation in training, knowledge, information and everything that can really be important for their situation.

4. The last point that I will highlight is that after ten to fifteen years of an important effort in research and development, in the creation of new technology, it is now time to try to implement as much as possible of the result of that effort. It should be a shift from direct R & D or technology development to pilot projects, to implementation projects, to the use of results for real applications. In other words I would like to stress the fact that most of the activities that are contemplated in part of the Framework Programme are what I would call user driven and should be user driven, not technology driven.

I think if you take into account these four political considerations then you will have a better understanding of the different lines of the new Framework Programme. This will help you to understand better its specific objectives, and especially two of its six action lines - line number 1.c which deals with European telematic networks and line number 6, that deals with human mobility and resources.

I would like to finish by expressing the hope that the papers in this report can bring out some of the vast potential which telematics infrastructures will give to an integrated Community approach to distance training and education.

Community Actions and Priorities in Open and Distance Education and Training - Distance Learning Initiatives

R. Charters d'Azavedo, Head of Division, Task Force Human Resources

Introduction

The Task Force Human Resources, Education, Training and Youth (TFHR), created in 1989 by the Commission as a separate and autonomous service, is actively involved in developing strategies to improve education and training at Community level. One element of this is the development of strategies in distance education and training, an area having great potential as a response to current training problems. This area in particular is developed in consultation with other Community initiatives, both within the T.F.H.R. and within DG III[1] and XIII. This activity is in response to a request from the Council of Ministers, on 31st May 1990, to develop a Community approach in distance education and training.

It will help those operating in this domain if they understand something about the institutional background against which we are all now working and this is the intention of this paper.

The process of consolidating our thoughts began in 1987 in response to a request from the European Parliament to prepare a document on the current position of Open Universities in the Member States. The European Parliament asked the Commission for a report detailing the current activities and issues facing the Open Universities. This report on the state of the art in distance education in the Community - remember that the UK Open University started back in 1969 and we now need to know what is going on after 20 years of distance education in Europe, will be presented by the Commission in 1991. Included in the European Parliament question was a request to ensure that the Open Universities were involved as much as possible in the Community schemes on co-operation in the fields of Higher Education, Training and Research and Development, notably COMETT, DELTA and ERASMUS.

The Parliament also asked the Commission to study the feasibility of creating a European Open University. Answering this question, the Commission immediately took the view that it is not possible to go for a single European Open University. However, the Commission stated that what would be feasible is the networking of the existing distance education institutions in the Community.

Following this, the Irish Presidency, at the start of 1990, presented a paper to the Council of Ministers, again querying the current situation in open and distance education in Europe. Consequently, the Commission prepared a Staff Working Document[2] and I would now like to explain the thinking behind this.

Community Priorities

Europe is now facing a tremendous challenge in meeting the demands in skill levels, not only in technological matters but also regarding the cultural dimension. One possible solution to this would simply be for us to pool the excellent resources that already exist in the Member States. However, experience shows that it is very difficult to transfer a course from one country to another when you consider cultural differences and particular cultural reference points. What is possible, however, is to transfer some modules and to integrate course modules from one country into course modules from another, as long as courses are of the same type. So our view is that, although it is difficult, it is possible.

The Commission Staff Working Paper points out the various activities being carried out, what we have been doing, not only in telematics but also by basing solutions on "old" media- mail, PTT, audio and video - whilst simultaneously considering the development of the new media.

In many less developed regions, we do not have the telematic support which we need to support advanced telematics services for education and

1 SEC(90) 479, 7 July 1990 - Distance Education and Training (Commission Staff Working Party)

2 COM(90) 585 Final, 10 December 1990 - Towards trans-European networks for a Community Action Programme

training. One answer to that is to create well equipped regional study centres, something which is taking place already, for example in Ireland in collaboration with the UK. So it is possible to support less developed regions through the provision of some well equipped study centres. We should find money to do this, notably throughout the Community Structural Funds (ESF, FEDER and FEGOA).

The document also reviews several programmes concerning open and distance learning at Community level (such as the COMETT, ERASMUS, DELTA, EUROTECNET, FORCE, LINGUA and TEMPUS programmes) and at the Member States level. It also reviews some existing networks such as EADTU, SATURN, EUROSTEP, EUROPACE (but not CHANNEL E because at that time (February 1990) it was not yet transmitting). How do we go about networking all these initiatives? This is a key question. We should note that some are dealing with telematics and advanced communications and others are dealing with old media. Some are only course producers but others are only deliverers. And we do not have the assessment component - the consumer protection.

Community Actions

The Commission's Staff Working Paper points out 8 areas on which further European Community cooperation could focus:

i. The consolidation and further extension of a "Europe Open University Network" based on experiences in the field of higher education, as for example the EADTU network; and developing the complete institutional capacities of a wide range of educational institutions to deliver distance teaching effectively.

ii. On the SMEs, the less developed regions, the rural regions promoting the use of distance education for initial and continuous training.

iii. On the mutual recognition of qualifications between the two sides - the traditional and the distance education and training. We have some experience with ECCTS, the European Community Credit Transfer System, developed through ERASMUS, but we should apply this to other levels of education and training.

iv. On the training of trainers.

v. On problems like copyright. A Community Directive next year will make things easier here.

vi. On commercial exploitation. We should ensure that R&D should not go to waste, or worse, be picked up by our competitors.

vii. On studies of promising innovative approaches (joint and networked pilot projects, etc.).

viii. Finally, we need databases and information exchange to ensure, for example, that when an SME wants to access courses, it knows to whom to address its questions; what kind of course, what type of media and what are the costs and the time, the type of diploma, etc.? Databases can also help in the field of consumer protection.

These areas are in the package we have presented to the Council of Ministers in May 1990. The Ministers have now asked us to go ahead, to develop the ideas, to go further and present an integrated paper for an integrated initiative in 1991.

Cooperation

In the TFHR we are very pleased to see some small change in DG XIII's work programme. The DG XIII idea of an Electronic University is now no longer on option. We are pleased to see that DG XIII is now supporting and reinforcing the existing networks of education and training. There is, of course, a danger of duplicating effort. In order not to duplicate efforts, this year, for example in COMETT we asked DG XIII to be involved in the evaluation of the proposals. We are working together. This is a beneficial approach for both of us and a valuable way forward at the Community level.

We understand that DG XIII is not trying to investigate all technological approaches in open and distance education and training. A major initiative is, of course, in telematics. But we all need to consider that 90% of what is being done nowadays in open and flexible learning is in old technologies, most of it on paper. The future will be naturally telematics, using new media for diffusion. But we will have a transitory period of at least ten years before the user of new media is widespread. At Community level and in Member States, it is essential to stress the importance of training people now, in the use of new telematic systems. We need to emphasize the importance of rapid change and the use of technological solutions. We need to be more rapid in training and retraining people.

To finish let me present two more thoughts which point out a need for joint initiatives in the field of

open and distance education and learning.

The IRDAC - Industrial Research Development Advisory Committee - an industrial committee which advises the Commission on a range of issues on R&D, has launched a working party on education and training, chaired by Sir Robert Telford, President of the Marconi Company in UK. It has prepared two important documents, one on skill shortages and another on links between schools and industry.

The paper on skills shortages[1] will be adopted by the IRDAC plenary meeting in November and will be distributed soon afterwards. Industrialists are saying that Europe has a shortage of skills and with the conventional or traditional education and training systems, we cannot respond to this challenge. Continuing education should become a mainstream activity. One solution is flexible and distance education and training using the old technologies as much as the new ones. Let me quote from the paper on skill shortages:

> *"Current training systems in Europe are not sufficiently adapted to the changing needs of society.. This concerns in particular the updating of trainer skills and qualifications as well as the development of more efficient training tools and delivery mechanisms based on new technology and innovative teaching and learning approaches. Most SMEs cannot afford to send their personnel away for considerable periods of time".*

And IRDAC concludes:

> *"A structural effort in distance and flexible learning is required in Europe. Traditional distance learning systems should be assisted in redirecting their actions more towards industrial environments. In addition, new technology itself should be used in the production and delivery of training materials to allow for individualised learning and to increase the efficiency of the training processes."*

This points to a need across all sectors and sizes of enterprise to invest in and utilize non/conventional means of training. It also points to the need for a purposeful partnership in public and private training development strategies.

Another study financed by TFHR, DG XIII and DG V, will examine the new skills and the new qualifications that will emerge into the next century in new information and communications technologies. It will concentrate on the problems of employment as well as the problems which education and training will face in dealing with these new qualifications in the year 2005.

Two consortia are dealing with this problem. One has a top-down approach and the other uses a bottom-up approach. One deals more with the industrial aspects, the other more with the social aspects. These two reports will be presented to the Commission at the end of 1990. We have a serious shortage of qualifications in that sector at a European level if we compare with the US and JAPAN. To deal with this we need more education and training and consequently, a large effort in open and flexible distance education and training with better productivity.

Distance education and training have a major role to play in the solutions of the huge training problems which face Europe in the future. I hope that this report and the cooperation between the interested parties will bring forward suggestions on how to progress.

1 Skill Shortages in Europe - IRDAC opinion , IRDAC November 1990

Rationale for a Telematic Infrastructure for Distance and Flexible Learning (Electronic Universities)

Luis Roselló, DG XIII, F, DELTA

Networked training offers the long-term possibility of significant cost savings and widespread use of training services. The main factor for success is a long-term commitment to service infrastructures, standards, protocols, technological evolution, tariffs etc. coordinated European-wide. Although networked training is in its early stages, technologies and telecommunication networks are mature enough both to convey training applications and to meet the increasing demand for flexible learning services. Many organisations need to access training services and skills as and when they need it. This is particularly the case with SMEs. Nevertheless it is necessary to develop a clear market rationale and long term planning in order to promote investments leading to the establishment of infrastructures to support training services.

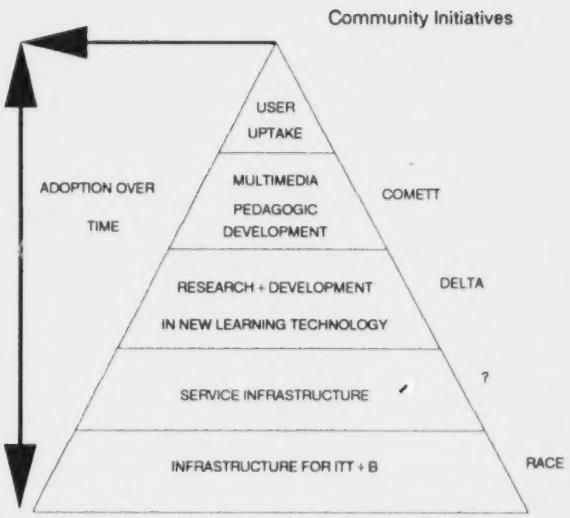
Evolution might be hindered by the use of incompatible systems. There is a risk of spreading too thinly the scarce resources for distance learning by developing competing schemes which later on will not have any significant impact on the market.

The potential advantages of a common infrastructure for telematic services in distance and flexible learning are as follows:

- Meeting the demand of flexible training
- Enabling the educational system to offer vocational training to adults at work
- Better economies of scale
- Setting up an experimental environment (test-bed) in which trainers and technologists can pilot new techniques, as the telecommunication infrastructures and learner technology evolve.

The approach should neither be a top-down nor a technology-driven new infrastructure on top of the existing ones. Rather, it should be to form a basis to support existing networks in order to facilitate both interoperability amongst them and portability of the courses developed. To foster consensus building and awareness on the development of services based upon compatible technologies and standards is essential for success. It should provide a user-oriented basis for the development of technologies and systems and a test-bed for future technologies. An evolutionary strategy should enable future extensions of the services provided, according to changing user needs and the emergence of new possibilities arising from the emerging technologies.

There has been a missing link in the Community initiatives in Distance and Flexible Learning. There is R & D on infrastructures for ITT&B (RACE), there is an R & D Programme for the development of new learning technologies (DELTA) and a development of multimedia for learning applications (COMETT). Now the time has arrived to prepare the emergence of a service infrastructure. (Fig. 1).



A simple model representing the role of Community programmes supporting the adoption of new distance learning techniques and services in Europe.

Figure 1

The follow up of the R & D in this field should, therefore, provide a framework for carrying out pilot tests related to feasibility studies for trans-European infrastructures. This would make possible the drawing-up of implementation plans for future services. Such plans of course depending on the outcome of these pilot experiments.

R&D in Telematics Systems for Distance Learning

One of the chief concerns for the new Framework Programme is the future implementation of trans-European services. This is the key issue for the new Action Line 1-c "Telematic Systems in Areas of General Interest". The main goal is to pave the way via incremental R&D, for the implementation of telematic services in health care, transportation and education, amongst other areas.

Initial studies have identified three main thrusts of research in our specific field, the establishment of telematic services for flexible and distance learning. The actions envisaged should address the key topics which will enable the future availability of trans-European services for flexible and distance learning based on telematic infrastructures.

The core is Part II, technology and systems development. This aims to identify the key technologies and systems required, and, by adapting existing communications and information processing technologies already available, to harness them for educational purposes. However, if we bear in mind the main goal, the key issue is to achieve interoperability and portability of learning materials and the definition of specific standards to fulfil the functionalities required for the users: tutors, producers and, mainly, the learners.

There is a need for this technological development to be pedagogy-driven and, at the same time, it is necessary to involve the different categories of users in the definition of the standards just mentioned. Pilot testing of these configurations is also needed. In other words, real-life trials to ensure the final performance of any development, to validate the technology and the systems.

This work will encompass information systems which allow accessibility of learning materials on a European-wide scale, the design and production systems making possible joint courseware development and remote learning services and learner tools which support the tutors and learners. There is room for local (off-line) tools and for on-line services; both are essential ingredients of

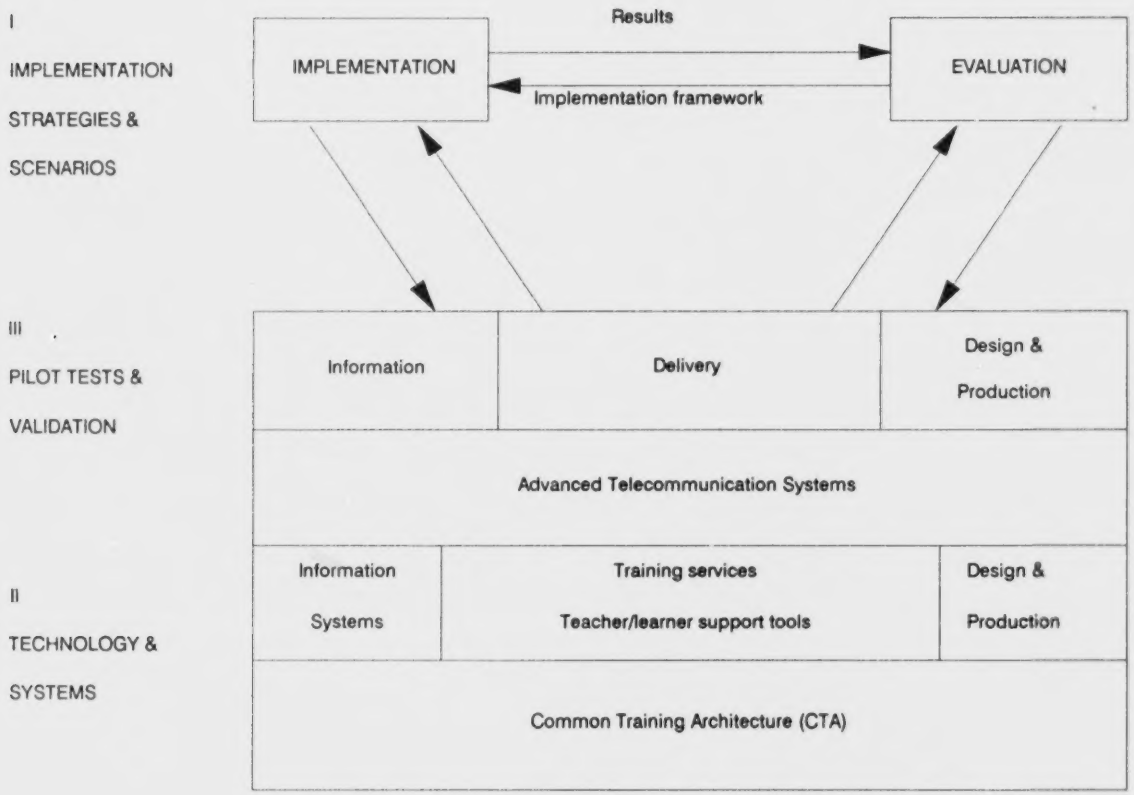


Figure 2

any distance and flexible learning service.

Finally within this part of the programme, the trial of different configurations of technologies facilitating interactivity at a distance via Direct Broadcasting Systems and other advanced Communications systems, should develop and test new advanced and innovative ways for delivery of training.

Part I of the future research can be called "Implementation Strategies" and is aimed at

- identifying market requirements and conditions,
- the awareness actions needed to build-up a consensus for setting-up trans-European services
- addressing the overall evaluation system which will enable the matching of the changing technologies and learners' requirements within a coherent model, making the assessment of achievements and their market impact possible.

The monitoring of the experiments undertaken within a coherent set of criteria will mean that comparable results introduce the required feedback to the test trials on the one hand and, on the other, the upgrading of the whole model, an important element of any implementation plan. (Fig. 2).

The real implementation of these services is beyond the scope of this R&D framework. Nevertheless, some pilot testing experiments should be undertaken in order to build up scenarios and plans for implementation which are to be based upon the results of real-life trials. This is Part III of the R&D we are currently envisaging. These pilot experiments will address the main areas of delivery, information and joint design and production of courseware.

The assessment of the feasibility to set up a trans-European electronic infrastructure for distance and flexible learning: this is the main goal of these pilots. They must establish a structure for the exchange of information on the technical standards, networks and protocols they are using. They will follow an implementation plan for larger-scale services as well as incorporating the new technologies developed in Part II. A market impact assessment and a validation of didactic approaches based upon different technological configurations and an assessment of the associated performance and costs should be an integral part of these experiments.

The assessment of the requirements and available resources, which will be undertaken by the pilot experiments, the implementation scenarios they will bring about and the concertation mechanisms put into force will contribute to the overall tasks in Part I. They will do so by providing the field trials needed for the consolidation of a full implementation plan. The overall goal is that the research as a whole will bring about a sufficient market rationale, availability of technologies and commitment of the actors to foster the investment needed to set up this infrastructure. (Fig. 3).

Telematics infrastructures for flexible and distance learning

Implementation scheme

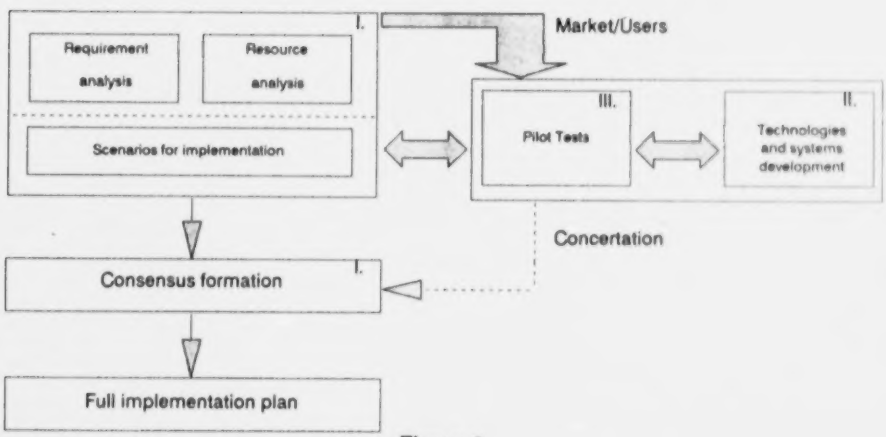


Figure 3

Developments and projects

Some of the DELTA Exploratory Action projects have already started the preparatory work for setting up these infrastructures through feasibility studies, (JANUS network) or by the development of distributed production systems at a distance (CAMCE project); other Action Line III projects are currently testing telecommunication-based experiments including some key issues such as the teleloading of still images or videoconferencing systems. Other initiatives are related to the delivery of broadcast materials. On top of that, other initiatives (EUROPACE or EUROSTEP) are working on delivery via DBS systems. Proposals for further extensions of the work are being put forward (DEDICATED, EADTU, etc.). On the other hand, Operation '92 has been put into circulation in order to gather comments from the potential actors, trying to follow up the DELTA Exploratory Action within broader objectives on the basis of the Telematics Services for Distance Education and Training, as proposed by the new Framework Programme.

Questions addressed

Provided that the objectives of this action are known and shared by the European actors, the key questions are how best to shape these proposals, how best the Community might ensure a coherent framework for them and how best the projects can contribute to the overall goal, which is beyond the reach of any individual project. The former raises some more specific issues:

- What are the criteria to launch any pilot test aimed at the future establishment of trans-European infrastructures for distance education?
- What kind of experiments might be considered as a priority?
- What kind of evaluation should be carried out?
- How best to ensure a common framework enabling comparable / integral results from these pilots?
- How best to set up links between these pilot experiments?
- How best to achieve consensus on technologies and standards?
- How to relate them to the technology and the standards brought about by the projects involved in technology development?
- How to derive Implementation Strategies from these pilots?

These are some of the questions addressed to you, the experts, today attending this workshop. I am sure that your valuable contributions will greatly help to enlighten these issues.

In conclusion, the matching of these experiments with an implementation framework will be a step forward for the implementation of European-wide networked training. The contrary approach would lead us to some isolated experiments which may succeed in finding a market niche, but would not mark a real advance for the Community as a whole.

TOWARDS THE EUROPEAN ELECTRONIC UNIVERSITY

Rhys Gwyn, Manchester Polytechnic, UK

In this paper I offer an assessment of the developments now most needed if we are truly to build upon the very valuable work which has been initiated and which is still on-going within the DELTA Programme. While my assessment is a personal one, it does draw closely upon the DELTA documentation and specifically upon the current definition of DELTA Tasks. I believe that my observations also fall very much in the spirit of the very important dialogue which is now in evidence between DGXIII and the Task Force, a dialogue which must make a very positive contribution to both the development of DELTA and its acceptance in the academic world.

Developments within the Pilot Phase of DELTA are producing very interesting results, which will have a major impact, we hope, upon the shape of advanced learning technologies (ALT) in the near future. We are perhaps not quite at the point of seeing everything to emerge from the first phase, but we know enough to have a view of where it will have taken us; we know, in short, what is going on in the technological sense. But technology development per se is only one component of the total picture. Technology development will have to be given a context.

My question then is: where should we now plan to be going, so that we can advance upon the first phase? In particular, I address the question of the context for development application, and above all for the evaluation of development. What do we need to do to establish that context? How do we identify the most appropriate next steps to take, especially in the context of the Pilot Applications about which we must now begin to think? My tentative answers to these questions will not be technological answers.

I make certain assumptions. In particular, I shall refer to "the" European Electronic University (EEU), but when I do, I want to assume that we are in fact talking about a virtual university ("virtual" as in virtual memory or virtual reality) and not about a new, or single institution. I believe that we all assume some form of association or collaboration - properly regulated and monitored - between a number of providing organisations. In the first instances at least, I assume that these organisations will be the ones that we know already; they are likely to include both the distance Universities and older higher education institutions as well as bodies such as Euro-PACE. I want also to assume that we take for granted that the EEU will be truly European, that its providing institutions or organisations will be drawn from all countries of the Community, and that, on any particular course of study, students may be recruited from divers countries.

I also make the further, to me very important, assumption that everything the EEU does it does electronically.

In practice, this will not be the case. Books and papers will not disappear overnight, nor should they. But I use the electronic assumption as a kind of touchstone or criterion for what the EEU is designed to be, which for me is embodied in the assertion that, in a fully electronic EEU, there is no need for any two persons ever to meet face to face and that all transactions are mediated electronically. This is a very simplified criterion, but it is one which I find useful. I do not claim, of course, that it is necessarily desirable to cut down on human encounters; it is a criterion, no more.

If we focus on the statement "everything the EEU does, it does electronically" we find that we have to ask ourselves: what exactly is "everything" in this context? When we address this question, I think we very soon find that so far, we are only tinkering around with unrelated aspects of the EEU and that, although I repeat the insistence that the EEU will not be and should not ever be a single "institution", there are nonetheless major questions of organisation which we can no longer avoid if progress is to be made.

This is what I meant when I referred to context. We have a great many technological advances being made, recently summarised for us by the DELTA team. The sophistication of some of these advances is impressive, sometimes breathtaking. What worries me is that perhaps their very sophistication is making us lose sight of something which I believe is of very great importance, namely the twin needs to keep in touch with a real world, and to keep in touch with simplicity - above all, simplicity of the basis of what we are trying to do.

DELTA is operating in an environment where it is essential to be aware of the dynamic between technology push and needs pull. So far, and despite the important changes in orientation over the past twelve months or so, the dynamic is still heavily balanced in the direction of technology push, and I think that we still need to redress that balance.

It seems to me especially critical in the present situation that the technologies in question are sophisticated; secondly, each carries a heavy financial investment (and therefore a heavy tendency to become a self-fulfilling prophecy, come what may) and, finally, they are necessarily very diverse and are therefore likely to come on stream at different times. Put very simply, my greatest worry is that the development of an educational service, or set of services, will be driven by a set of technological advances which will become available to us in an uncoordinated fashion, each affecting a part of the total provision needed, but each temporarily distorting our reading of that overall provision.

An example is the insistence found in DELTA from the beginning on courseware production: this is clearly important, and it will have a major impact because courseware can be automated. What we have to hang on to, very firmly indeed, is the realisation that automated courseware, no matter how good, can only be one component in a total provision.

I have seen some very effective courseware which uses interactive video as its medium, and I entirely support the need for further development in this field. What I would entirely reject is any suggestion that, in the future, such courseware is all that we shall need.

No-one makes such a nonsensical claim, of course; I merely worry about the emphases which I find in DELTA so far and about the danger that they may become orthodoxy. Automated courseware has a place, no more. Is it subversive also to think that place is the technical college and not the university - that its role is in training and not in educating? Even more: that it only partly fills the needs even of the technical college. In these as in other ways, progress must come form a careful analysis of the needs pull as well as from the technology push.

If we are to make such progress, then I think we need to step back for a moment and try to create a map of needs, specifically of the functions required within an EEU. When we attempt such a map, we find that we already know quite a lot about performing some functions by electronic means. Unfortunately we know next to nothing about performing other functions electronically.

I am using a working definition of a university or Higher Education Institution (HEI) which is that

- an HEI is a human community which exists to provide structured environments for the processes of teaching, learning and researching
- and which provides the services necessary to support such an environment.

If the term "human community" conjures up pictures of medieval monasteries, so be it; I make no apology. It is perhaps no bad thing to remember our intellectual origins as we wrestle with problems of technology-led change, and certainly no bad thing to remind ourselves that the work "community" shares its etymology with the work "communication" (as in "communications technology").

What we need to be clear about is that we cannot go much farther with our experiments in DELTA without engaging, at least in some measure, with the need for a context to which I referred earlier - with the creation, in fact, of some such community in formal terms. There will have to be a real context in which DELTA Products can be put to use, and that context will have to look something like an electronic HEI. It is essentially the recognition of this need that lies behind the definitions of Tasks 320 and 330 in the DELTA Consolidation of Results, and I believe these tasks to be of critical importance for development.

Current thinking about vocational training supports the need for future employees to acquire a range of flexible skills, including skills of human interaction, as much as an ability to perform set tasks to maximum effectiveness. See, for example, a.d'Irivarne, New Training and New Skills in Factories, Vocational Training 1/1987, Berlin, CEDEFOP 1987.

We need therefore to build up our understanding and experience of what it is to create such a community by electronic means, and using the tools which DELTA will place at our disposal. We have to understand how the processes and services which go to make an HEI can be delivered electronically. This, I suggest, is not a matter for technological development; it is a matter of building up communicative structures based on the technology on offer. If we can be clear about such structures, we shall be better placed to see where the various technology advances fit it - and where there are gaps.

It is worth looking at some examples of the services and processes to which I am referring.

Before we can begin to talk about there being a university, there has to be a range of services which incorporate the following. They must:

- inform prospective students about programmes

- register students
- assign students to course units/groups
- maintain records of students progress.

At a second level, there must be services which can:

- design and approve courses and course units
- identify course levels
- arrange mutual recognition between provision from different sources.

At a third level, services must:

- employ and remunerate academic, registry and finance staff
- provide library and other resources
- provide accommodation, catering and welfare support
- ensure overall financial management.

Finally, in this arbitrary list, there must be services which

- allocate staff to courses and course units
- timetable staff and students
- set the overall calendar for assignments and assessments.

Let me insist again: I am not talking about the creation of a new, single institution. But I am talking about services which will be needed if the idea of the EEU is ever to get beyond the level of experimentation involving small groups of volunteers. We have to acknowledge that there is a limit to what we can expect from volunteers; they are, after all, learners in their own rights with a need, for example, to have some form of recognition for time spent and work done. We need to get into real systems sooner rather than later.

It is instructive to ask: In the EEU of the near future, how many of these services will be made easier to provide simply because the whole thing is electronic? Are there some - catering is one apparently obvious choice - which are rendered superfluous? And if catering is not needed in the virtual, electronic world of the EEU, is it quite as obvious that student welfare services are superfluous? The need to move fairly quickly form experiment to prototype will force us to face these and many related issues.

If we turn from the support services needed by an HEI, what about the processes of teaching and learning that go on? Again, we can offer some very broad categorisations. If we are to set up the EEU's of the future, then we need to think about a range of processes which include:

- instruction, including lecturing (and automated courseware)
- student access to resources
- seminar discussions
- submission of course work
- tutorials
- assessment and feed-back

as well as the informal processes:

- student chat
- student politics
- student newspapers, societies, social events
- falling in (and out) of love.....

How many of the above processes do we intend to support in the EEU? How many of them will be modified by being electronic? In what ways will they be modified? How many are rendered superfluous? How many of these processes will be supported by the technology development now taking place? To take just two examples: I believe that we already know, in fact, quite a lot about electronic delivery of lectures; we know next to nothing about the conduct of electronic seminars. Yet the seminar is as important a mechanism for learning as is the lecture.

If the EEU concept is to be developed, then I think that we must put some flesh on the idea. The challenge is, as we must insist, that it is not the intention to create a new institution, so that we are faced with the need to provide sufficient flesh for the experiment to be real without creating new bureaucracies. The flesh needs to be in the form of mechanisms for human interaction. I suggest the following guide-lines for progress.

First, in respect of services, since the EEU is not to be a new institution, we should extract essential services from what exists already, i.e. existing HEIs, both distance and traditional and also from organisations such as Euro-PACE. Where necessary, these services will need to be mapped onto the technology offer, but in many cases (for example, student registration and progress recording) services will be electronic already and will need relatively little adjustment to take account of the fact that the student does not appear in person on the doorstep. Issues of course approval and

accreditation will need careful examination, as will issues of credit transfer for students. It is a large, and I think very interesting, challenge, but with luck, however, this will prove to be the easy bit.

In respect of the teaching/learning processes (for sake of simplicity, I leave out research) we probably face a more sophisticated set of challenges. We need to experiment with a whole range of approaches; through the experience of, for example, the OU and more recently Euro-PACE we already know a lot about distance teaching but I suspect that is about all. We have a great deal to do just to exploit existing technologies, and we need to make a real start here while at the same time pressing ahead with new technology advance and feeding that into pilot experiments. It is at this level, that of process, that we are likely to encounter difficulties; it is the challenge of Task 330.

And throughout, we need to examine closely the dynamics between technology push and needs pull.

I shall take just one example of the kind of experiment that I think we need in respect of process; this is an area which we are exploring within the PLUTO Network. Just what is it like to run an electronic seminar?

The traditional seminar is in one place, in real time. A number of people gather together and interact with one another. Views are exchanged, positions defined, conclusions, perhaps, arrived at. Then everyone departs - perhaps to re-assemble in week's time, perhaps to continue the discussion over coffee, but the seminar, as such, is concluded.

An electronic seminar is not in real time. Contributions to discussion are made asynchronously. There is no physical place, and interaction is not aided by gesture, tone of voice, body language. There are no distractions from the personal behaviours of others, which may be irritating, or if we are lucky, alluring. It is to me self-evident that technology advance will enhance the environment in which the electronic seminar will take place, but the key questions which I find myself facing are: with how many students can I interact electronically? How can they interact with one another, impact upon discussion? What might be the timeframes in which contributions to discussion to be posted? How do I give a weighting to the quality of contribution? In a European context, what allowance do I make for language difficulties? Is the electronic dialogue going to favour some learner styles and disadvantage others? Does this matter?

If we address the topic which has been given to me for this paper, namely "Towards the Electronic University", then I feel that we have to face issues such as these. Similarly, we have to address the issues attendant upon other processes and also upon the provision of support services. We can do this from within existing institutional structures, but we must make a beginning.

The EEU is not just about distance teaching. It is not just an excuse for technology development.

The EEU is about the development of electronic communities for the purposes of teaching and learning. It is about communication, above all communication between human beings.

What DELTA needs more than anything else is experience in developing such communities, so that we can learn more about electronically-supported processes and services as operated by human teachers, human learners and human support staff. If we can do this, we can move towards the EEU. Fortunately, I believe that DELTA development is now facing up to these challenges. The Application Pilots will be of intense importance. The two tasks to which I have referred specifically, namely 320, Joint Course Development and Production Systems, and 330, European Course Delivery Systems will be the real test of whether we can, in fact, live up to the challenge of developing the European Electronic University of the 1990s and beyond.

DEVELOPING ACCEPTANCE - How Can Integrated Systems be Used for Industry-Oriented Distance Education and Training?

Søren Nipper, EuroPACE

1. What are the issues?

It might be useful to open this paper by sketching my personal understanding of some keywords used in the title.

I'm not at all worried about integrated systems or educational technology. Technology is OK. I'm more concerned about our lack of imagination. We, ie 'the European Distance Education Community', seem to be stuck with a somewhat single-minded approach to what distance education technologies actually can and should do for us.

The shortcomings in present-day technology-based distance education are not due to technological imperfection or inadequacy as such. Some technologies may be deemed more appropriate than others, educationally speaking. But currently available technologies are actually quite adequate, and little effort is required to integrate them, technically speaking.

The hard times come when you start using them, be it as a provider or as a user of technology-based education. Our understanding of the educational, pedagogical and organizational characteristics of distance education technologies and media is still incomplete. Flimsy, if you prefer.

The really fascinating challenge for telematics based distance education therefore seems to be in developing acceptance with the users: those who produce and/or teach educational programmes and those who learn.

That again is a very straight-forward issue. We will have no basic problems with getting acceptance, as long as telematics systems are used with the clear objective of producing and delivering good quality education to learners with real educational needs and requirements. Quality education will always be accepted and used by those who need it - no matter the technology.

Integrated Systems and Telematics Networks, therefore, should be evaluated on their ability to:

- support good, useful and needed education
- give broadest possible access to education

A book is a good piece of technology in this respect. So is a pencil, a typewriter and a telephone. And even for more advanced telematics networks and systems, we're already well off. We have good, accessible, reliable, cost-effective and yet sophisticated technologies available off-the-shelf. Current trends in industry-lead developments of multimedia workstations and new networks will very quickly enhance the possibilities further. Not least when these technology developments gain support from new market-driven regulatory mechanisms more sensible, and more sensitive to users' needs and users' constraints than the present ones.

Educational technology should be evaluated on educational parameters, not on technological. It is profoundly misleading to compare one technology with another. In almost all cases such an approach leads to nowhere or, in the worst case, to confusion about the educational objectives that are (supposed to be) carried by the technologies, mixing apples with pears. It reminds me about the Danish politician who, in a heated discussion about Communism in Eastern Europe (long before November 1989), started to say: "If I had to choose between bread and freedom, I'd choose ..." and then realised that was asking the wrong question.

Therefore,

- The appropriate components for telematics networks and integrated systems are at hand
- But no matter how many protocols, standards and pipe-cleaners we use to tie these components together in an integrated system, the real integration of systems is only achieved when users use the components in a cognitively and socially integrative way
- The users will (and should) only accept the integrated systems as long as these are not treated as substitutes for traditional (distance) teaching and learning methods, but as systems that encompass a fundamentally new understanding and organization of adult education.

What we need most is to 'think' new social and educational models, or, what the management literature sometimes refer to as 'paradigms'. That's basically a question of imagination and the ability to step outside old scenarios. Stepping out of your old scenarios is not at all a trivial thing.

2. EuroPACE: a pragmatic approach

EuroPACE, the programme I am representing and presenting with this paper, has been characterized not so much by its technological sophistication, but rather by its pragmatism. Vis-a-vis the distinguished audience of educational technologists assembled here today, EuroPACE certainly has not much to offer in terms of technological innovation. And compared with the complexity of a European Community programme such as COMETT, EuroPACE is quite targeted and limited in its educational scope.

As we were and had to be very pragmatic when setting up our network, and as we are committed on meeting very specific educational needs, we clearly can learn a lot from listening to the development oriented projects presented here today and to all the other projects participating in the DELTA and COMETT programmes.

However, the pragmatism is key to understanding the rationale of EuroPACE:

EuroPACE is user-driven, and it has been so from the very outset. EuroPACE has one prime task: To develop and deliver educational programmes that meet the requirements of its usergroup. This usergroup is directly involved in the planning, development and evaluation of EuroPACE's curriculum.

Further, being demand-driven and, as far as possible, operating on a 'just-in-time' basis, involves a fairly complex network of programme advisers, subject experts, producers, local receiving site managers and, of course, end-users.

Working with and supporting this network has been a tremendous, and still ongoing, learning process. We are happy to share our experience with colleagues from other European distance education projects, and we are flattered to have been invited to contribute to the discussions at this workshop on Telematics Networks for Distance Education & Training.

II.1:What is EuroPACE?

EuroPACE develops and delivers advanced continuing education programmes. The target group is European company professionals and managers as well as university staff and post-graduate students. Currently 6 subject areas are addressed:

- Artificial Intelligence/Expert Systems
- Software Engineering
- Advanced Manufacturing Technologies
- Telecommunications
- Microelectronics
- Technology Management

A new subject area, Information Systems Management, will be added to our programme as from the 1991-92 Academic Year.

EuroPACE's objectives are tangible, and they reflect very tangible requirements:

European industry needs enhanced, faster and more cost-effective access to leading-edge information. It needs to disseminate this information to growing segments of its population of professionals and managers. It needs to provide access to quality education in leading edge technologies, technology trends and research findings to more employees and on a more frequent, continuous basis than ever before. The expertise holding this information is scarce, highly demanded, therefore hard to get access to and, obviously, priced accordingly. EuroPACE has been set-up in order to improve and broaden industry's access to this expertise - and to reduce access costs. EuroPACE was set-up, not least, to short-cut quite common delays in development and implementation of this type of educational programmes; further, EuroPACE will provide fast and regular updates and revisions of the programmes. Finally, EuroPACE acts upon demand: Its curriculum must be targeted and relevant to the users.

Distance education methods are best suited to meet these tangible requirements. We utilize a variety of distance education technologies, media and tutorial approaches:

- satellites for broadcast of recorded and live video programmes
- printed support material, delivered by surface mail
- computer-mediated communication by means of terrestrial networks
- phone, telefax
- local tutorials
- local peer groups

Our basic philosophy is that all tricks apply as long as they enable us to meet our objectives, and in so far as they allow us to shorten and integrate the loops that constitute a distance education environment:

- Curriculum planning & programming
- Programme design and development
- Delivery
- Interaction
- Evaluation

I'll come back to this later on in my paper.

The first experimental programmes were broadcast in Spring 1988. As of today (October 1990) upwards 700 hours have been developed and broadcast. We are currently producing close to 300 hours of new programmes during the Academic Year.

Programmes range from 2 to 30 hours in duration and are normally transmitted in modules of 2 hours per week. The main part of our programmes are studio recordings. We do, however, to a growing extent produce on-location reports from key European (and overseas) technology events related to the subject areas. We have, for instance, made quite comprehensive reportages from the ESPRIT Technical Weeks that took place in 1989 and 1990, thereby probably multiplying the access to this very important event with a factor 3 or 4. Short Live Seminars of 2-3 hours duration are organized regularly, and at least once every month.

The EuroPACE programmes are currently received at more than 150 industrial and academic locations, or Receiving Sites, in 16 European countries. We expect that +200 Receiving Sites will be linked to our network by the end of this Academic Year. A large number of our Receiving Sites operate as regional re-distribution and support nodes that make the programmes accessible to SMEs. Based on feedback from the EuroPACE member organizations, it is estimated that 2-3.000 persons will be using the programmes that are being broadcast this Academic Year.

The Receiving Sites are the backbone in a network that carries the development and implementation of EuroPACE's programmes. As of today this network comprises upwards 400 persons from all over Europe. The network includes programme advisers from member organisations, subject experts teaching the programmes, video producers, Receiving Site Managers etc.

It is a geographically highly distributed and truly trans-European network. It is trans-corporate, trans-sectoral, trans-cultural and multi-lingual. It is very dynamic, and so it has to be. The network is the single most important asset in EuroPACE and probably unique. To keep this network alive and integrated, to support it while at the same time extending it, is the key to EuroPACE's success. The information-flow within the network, the interaction among groups and individuals, establishing consensus, co-ordination and synchronisation of actions. This all amounts to a very complex daily exercise. This is where the excitement, the challenges and unique opportunities - and, obviously, the problems, start. But dynamic networking is indispensable for the type of distance education that EuroPACE is aiming at.

It might therefore be relevant to spend some time looking in more detail at the different loops and subsets that are merged - or integrated - into the overall network.

2.2 Short, open and integrated loops

EuroPACE programmes evolve through basically the same 6 or 7 loops as does most other distance education. It is, however, imperative to the educational concepts and rationale underlying EuroPACE that these loops are kept as short, as open and as integrated as possible. Open Loops seems to be a contradictio-in-adjecto. By open I mean processes which bear an impact on each other, that are reciprocal and continuously developing in response to other processes elsewhere in the network. Organizational Networking, communication and interaction within and among the loops therefore are very important.

The loops can be described as follows (See Figure 4):

Curriculum Planning (Loop 1)

The six Programme Advisory Groups (PAGs) that establish the curricula within the subject areas. A PAG is composed of representatives from the EuroPACE member organisations and by personally appointed experts within the subject area. The PAGs put forward the programme requirements and set-up the overall objectives for each programme in co-operation with members of the EuroPACE staff. Approx. 120 experts from industry and academia participate in these PAG networks.

Programme Development (Loop 2)

The programme development reflects the input that has been provided through the PAG net-

A EuroPACE Scenario

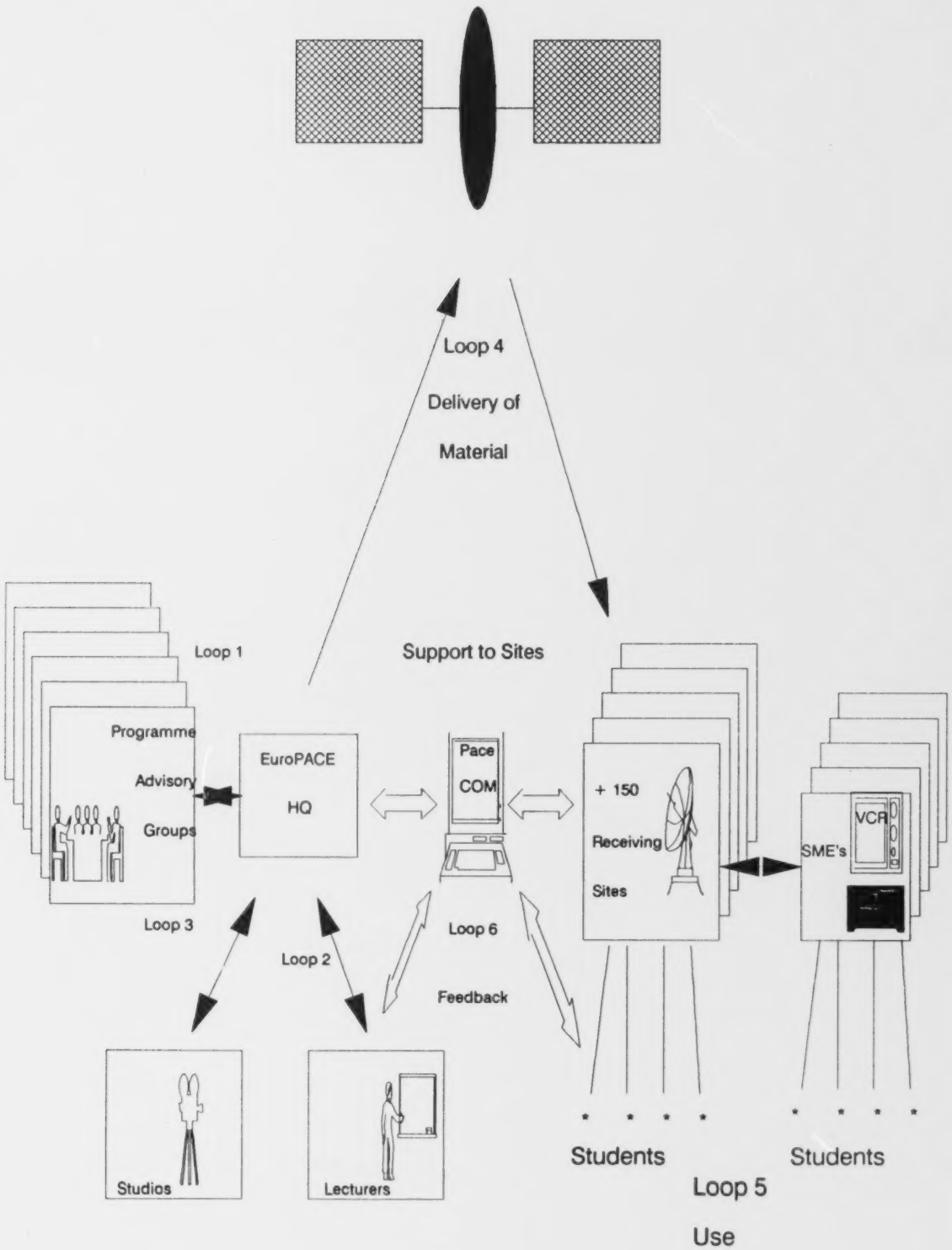


Figure 4

works. More than 300 subject experts have contributed as lecturers in the EuroPACE programmes, some of them, however, with only one or two lectures. A 20-hour programme may typically involve 8-10 experts from different organizations and different countries. EuroPACE staff members liaise with the lecturers, and in particular with the Course Coordinator, during the programme design and production phases to ensure content co-ordination as well as consistency in educational and pedagogical approach (level, target group etc.).

Programme Production (Loop 3)

EuroPACE's video programmes are produced all over Europe, by close to 30 different studios. The studios are often closely involved in the programme design and in helping the lecturers adopt the most appreciate presentation techniques. This is a very important process as only very few of our lecturers have previous experience from developing educational television programmes.

Delivery (Loop 4)

EuroPACE broadcasts 2 hours every weekday to the 150 Receiving Sites. Local Receiving Site Managers take care of recording the programmes, duplicating printed support material, setting-up local technical/physical facilities for the users of EuroPACE programmes, announcing and marketing EuroPACE offerings to local users, organizing tutorial arrangements, peer-groups as well as (practical) support to individual users.

Not least important: The Receiving Site Manager is the key source of feedback to EuroPACE staff on technical and operational quality problems, as well as on end-users' evaluation of the educational and pedagogical quality of the programmes. The role of the Receiving Site Manager is absolutely key and extremely complex: they are, as said, the backbone of the whole network and the very link that integrates the loops from curriculum planning to programme evaluation.

Use and Feedback (Loop 5 & 6)

A variety of local models have been applied, from self-paced work outside workhours, to peer-groups and organized classes with tutorial support by either in-house experts or experts recruited from local higher-education institutions. These models reflect different corporate and national policies and cultures towards on-the-job education and training. It is an issue that has attracted much attention and generated much discussion within the EuroPACE usergroup.

It is an extremely important discussion: On-the-job education - and not least distance education - generates a number of complex organizational and social requirements that will have implications not only for time/work priorities, but which in time will impact the overall corporate training policies and programming practices. It is still an area where much experimentation is required.

In the particular context of EuroPACE, one question emerges: what support, what types of interaction, what types of assignments, what types of learning material, what types of (in)tangible encouragements will motivate the adult learner who is already her-/himself an expert in the subject? Is the very access to other experts in itself a driving factor?

The end-user loop therefore takes many different forms in EuroPACE, from very informal chats with colleagues, to highly structured tutored sessions. Two things, however, have been surprising and striking:

- Up to now we have only seen very few examples of interaction across/between local (national and corporate) end-users, although the possibility for trans-corporate end-user communication are provided through our terrestrial network. The end-user networks seem to develop and remain within the local environment, either located at one receiving site, or distributed between several sites within one corporate organization.
- Secondly, although many EuroPACE lecturers have been contacted directly by end-users for additional information, clarifications, references, questions etc., the feedback to lecturers has been surprisingly sparse and scattered. The contacts established between the lecturers and the end-users have almost always been on an individual basis.

So, while we have indications that local end-user networks gradually are growing up, these networks still cannot be seen clearly within the open EuroPACE network. There may be several reasons, to which I will return later.

The distance education concept from which EuroPACE develops its programmes, is based on the necessity of inter-connecting the loops and processes involved. These loops must be open, that is inter-related and responsive to each other, but they must not be open-ended, that is leading into the void, to nowhere. EuroPACE programming can only evolve from iterative processes that

link those experts that define the curricula with those experts that finally end up using them. That's a necessity which comes from being a user-driven distance education programme. -

2.3 Media and technologies

EuroPACE utilizes a mixture of electronic and non-electronic media, non-interactive and interactive technologies. Our media-mix reflects the educational and pedagogical concepts and objectives underlying the programme. The specific technical configuration reflects the already mentioned pragmatism: EuroPACE has gone shopping for systems and services that

- were commercially available and technically reliable
- were geographically non-exclusive
- would support any terminal standard
- were easily accessed
- and are/were financially feasible from an operations' as well as a user-organisation's point-of-view

The price to be paid for insisting on these criteria obviously is compromises on functionalities and technical sophistication. We are convinced that this approach has made sense. But we do appreciate that technical compromises also can imply educational and pedagogical compromises.

EuroPACE only has one measure for whether the technologies applied are adequate and/or adequately used: Do the users use them, and do they find the educational programmes provided through them useful and of good quality? It makes our life relatively simple and full of challenges.

Our users certainly have pointed to mistakes and at a too constrained use of the media applied to our programmes. I would like to mention just two areas that have generated very strong reactions and, believe me, extremely interesting and useful discussions:

The use of the video/television medium for educational purposes instantly confronts you with (legitimate) user-expectations about the versatile way in which the medium can be used, the richness of the programme format etc. If you, like EuroPACE, mainly apply a lecture-format to your programmes (the 'talking-head' approach), you are bound to disappoint these expectations. The clash between what is expected from the medium and what has been delivered is indispensable and fruitful. EuroPACE is forced to develop new models for this particular type of educational television, models that bring us further than the models developed in the USA ('Candid Classroom') and in Europe ('Tutored Video Instruction'). The first model reflects an educational culture and tradition different from the European. The latter reflects the technical and commercial availability of the VCR technology in the '70s and early '80s, and the ideas about educational television that were based upon the particular characteristics of the video cassettes as a medium in itself.

Adding the satellite to the use of television based distance education is much more than just replacing cassettes and/or terrestrial broadcast with another dissemination technology. The satellite in itself becomes a medium and seems to have set a drift towards synchronization of the distance education environment. If this is true, satellites will have a profound impact on the concept of time-space-pace flexibility in distance education and on the basic organization of distance teaching/learning processes. And it will certainly require new scenarios for the use of the television medium.

EuroPACE has been very much in line with much other distance education in Europe in stressing the benefits of and requirements for time-space-pace flexibility. We have, though, to evaluate when too much flexibility becomes educationally counter-productive.

The second area that I would like to mention as a major challenge to us, is interaction and communication within the user-community. The lack of educational interaction in EuroPACE has been disappointing. The conversation and the dialogue is a key paradigm, deeply embedded in European educational culture. The level of interaction often is used as a measure for good or bad teaching and for the achievement of learner satisfaction.

EuroPACE is non-exclusive in the ways interaction can take place, but has proposed and operated asynchronous computer-mediated communication as the feedback/discussion environment. Whereas it seems to have been useful for operational coordination and exchange of ideas and experience, it has so far not been used very much in a strict educational/pedagogical sense. Some users have said that the actual systems used have had too many technical barriers to be used spontaneously by students that work with the EuroPACE programmes within relative small time windows (from a week to 2-3 months).

The most frequent comments, however, have not been on the technical characteristics, as on pointing out that EuroPACE initially has applied a too

voluntaristic approach to the educational management and animation of the system in order to make it sufficiently dynamic and thereby attractive and comfortable, both socially and professionally.

What we applied was old technology. What we've experienced, and what our users tell us, is that we still need to learn more about how to use it for distance education purposes.

So, we are still learning how to use technologies.

3. So, what are the issues?

EuroPACE develops only by and through our human networks. These networks represent the expertise, the ideas, the experience and the educational requirements that constitute the objectives and the huge potentials of this European project. Only by bringing these networks together, by establishing and continuously enhancing the co-operative and dynamic interactions within and between the networks, can we meet our goals and commitments.

The bottom-line is whether the users accept what EuroPACE can offer them. That acceptance is not achieved overnight. This perhaps is the most pertinent lesson to draw from EuroPACE: You have to design into your system the flexibility to change and to evolve in response to needs. I believe, this is one of the important lessons we've learned in trying to develop acceptance for our distance education system.

It is a matter of fact that EuroPACE is unprecedented in European distance education. What it is doing is new and unique, and it requires that new scenarios and paradigms are established. That takes a lot of work and a lot of learning. The results so far have indeed been encouraging.

Course Delivery and Student Support Systems for Distance Teaching and Training

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Introduction

In this paper my intention is to present a few basic ideas regarding telematic networks for Distance Education from the point of view of educational technology, as more or less opposed to information technology.

From an educational technology point of view, the educational functionality of networks for education and training comes first. This means a specific orientation, away from technological push, towards educational pull or demand. To illustrate this point, issues like "possibilities versus needs" and "infrastructure versus applications" will have to be discussed, with an emphasis on the use of networks by people, for actual learning purposes. Other network-components and other network-uses can only be touched upon.

References

To delineate our frame of reference, I would like to offer you a few definitions, the titles of some recent books and reports, and one basic assumption.

Two concepts are at the core of our current area of interest: distance education and telematic networks. Distance education can be regarded as a specific format of Open education. A useful definition of open and distance learning has been formulated within DELTA; "An open learning system is a flexible learning system which offers its users, within reason, the choice of how, when and where to learn" (Whiting, in: Whiting & Bell, 1987, p.142). Although from a broader perspective some may be inclined to add a "what" component to this definition, it serves our current purpose as it is.

Regarding telematic networks the following definition of "telematic services" is relevant; "a layered service available on a certain type of network which gives the user some well defined set of facilities or functionality, like videotex, teletex, facsimile, or electronic messaging" (Van Binst, in: Whiting & Bell, 1987, p.91). It will be clear, that " telematic networks" can be seen as the underlying, physical prerequisite for "services". But it will also be clear, that the types of "functionality" and "services" referred to, do not automatically imply educational functionality. For that, additional input and elaboration is necessary.

Concerning the above mentioned topics many books, reports and articles have been published. I would like to point out a few recent ones, which are directly relevant to this presentation and to our part of the world, and in my opinion, also give a nice overview on the current state of affairs, including actual practice;

Bacsich, p. et. al.
Electronic Networks for European Distance Teaching and Training
EADTU, Heerlen, The Netherlands, 1989

Bates, A.W. (ed.)
Media and Technology in European Distance Education
EADTU, Heerlen, The Netherlands, 1990

Mason, R. & Kaye, A. (eds.)
Mindweave-Communication, Computers and Distance Education
Pergamon Press, Oxford, UK, 1989

Whiting, J. & Bell, D.A. (eds)
Tutoring and Monitoring Facilities for European Open Learning
North Holland, Amsterdam, The Netherlands, 1987

Both the above mentioned references and this presentation are largely based upon activities in the area of HIGHER distance education. With regard to the nature of the following discussion however, it is reasonable to assume that this is also applicable to other areas and levels of education and training.

Observations

The use of telematic networks can not (yet) be seen as a firmly established element within distance education and training. Nevertheless, a considerable number of projects or experiments in this field are going on today. It is not possible here to describe, let alone analyse these activities in depth, but a few admittedly generalized observations seem possible on the basis of experience as reported so far:

1. Initiators and agencies involved appear to be satisfied with the current state of technology, at least as a basis for experimentation and sometimes as a basis for operational use on a larger

scale.

2. Many, if not most of the projects can be characterized as an exploration of possibilities. Frequently they are somehow "added on" to existing educational situations or systems and do not form an integral part of these.

3. For this reason, the considerable cost of network-usage is easily perceived as "extra" and difficult to justify, also because so far no significant effects have been reported regarding improvements in teaching and training as such, or the results of these.

4. In general, most of the projects have explored possibilities as based on technological functions ("services" offered); from the actual and often enthusiastic use of these possibilities by staff and student-users however new ideas and concepts for educationally functional use are born, varying from improved integration and adaptation (eg of tutor-roles), to completely new didactic approaches.

A pilot project in our own Dutch Open University of some three years ago, I concerning a course in systems-control, has been developed as a teleformat of the original course and was tried-our with about 60 students in practice. As an illustration of the exploratory approach I will show you the list of envisaged possibilities as originally related to this project;

- Tele-practice (on the use of a communication-network).
- Tele-teaching (of students at a distance).
- Tele-project (for students working in groups).
- Bulletin board (for students form the organization).
- Databases (to be searched by students at a distance).
- Distribution (especially of interactive courseware and tests).
- Electronic mail (among students, for any reason).

Apart from the fact that not all these possibilities came really into action, the experiment lead to roughly comparable observations as mentioned above, especially those regarding nature, results and cost.

Nevertheless, a lot was learned from this project. Without question it made us rethink our position and prepared us for a second and better trial - or so we hope.

Comments

Even if more recent, e.g. computer mediated communication or computer conferencing projects are concerned with less widely varying network-possibilities, in many cases all or at least part of the above observations remain valid. A core-comment indicated already and explicitly confirmed by the evaluators of the Dutch Tele-project, is the perceived lack of clear, coherent and integrated educational functionality.

Evidently time has come to re-phrase the question; if so much is possible with the help of networks in distance education, what SHOULD we do? Which problems can be solved adequately by network-usage and what do we want for true network-functionality?

Also, it should be decided if the underlying technology as required and/or available today is really sufficient. As stated above, this can and will not be dealt with in detail here, but a few basics must. The general concept of telematic networks refers to a bewildering complexity and variety of technical means, including LANs and WANs, cable and satellite communication facilities, computer hardware/software, and their many interfaces. Especially these last are not very much standardized and all components are under continuous development.

If actual network-projects are satisfied with the current state of affairs, this is either because they are building directly upon the possibilities as offered, or because they are geared to developments which can be seen as "main line", now or in the (near) future. This applies mainly to the communications facilities in the stricter sense, because even if those are also continuously developing, there are international standards emerging and their implementation is planned accordingly for the near (ISDN) or a little more remote (IBC) future. Even for other systems-components tendencies towards standardization can be observed, although less so with regard to interfacing, especially on the higher (user) levels.

In all, it seems an advisable course of action to accommodate to main-line developments, now as well as later on. Although the market for network-usage in distance education and training is potentially very large, a number of factors and especially the lack of coherence in this market (at the right moment) makes specialized or tailor-made telematic networks for education and training highly unlikely. Eventually, some relevant and relatively easy adaptations or additions will be

achieved, provided the numbers involved are large enough. Even proposals for a specialized user/learner workstation could have the best chances with such an approach.

To conclude, if we can accept current technological possibilities as already worthwhile and workable, the best policy to build upon is to stick to main-line technological developments as close as possible while looking a few years ahead, and to ask ourselves which educational problems or needs can be answered in exploiting technical possibilities as given in that way. Summarizing this paragraph, it leads to the following statement:

- Technology and infrastructure for telematic networks are not yet fully developed.

- Yet the current and forthcoming possibilities enable serious use of telematic networks for education and training.

- However, to justify this in practice it is important to shift emphasis from (mainly) exploration towards educational needs and functions, in terms of problem solving.

Elaboration

Let us now concentrate briefly upon the educational functionality of educational media in general, and of media for communication in particular. The last appear to be of a different character than, e.g. more familiar media like video, but in principle two basic notions are applicable to all of these (electronic) media.

In talking about "media", what is meant in most cases are "educational applications with the help of (electronic) media". Or in other words: not the basic physical means are meant, but the educational applications. In these, physical carrier, information content and didactic structure are combined into a specific format (the application). Applications can vary widely in purpose and structure, even if based on the same "carrier". Applications also can be combined into a so-called "mediamix", e.g. a course, but in that case they should be dealt with as interdependent parts of a whole.

All media can be chosen, as carriers for educational applications on the basis of their specific, sometimes unique possibilities, or because of concrete advantages in a specific situation. This could be referred to as the "added value" of media versus their potential "preferential value", which is more situation-dependent. This implies that, up to a point, media can and will fulfil comparable educational functions. In both cases the possibilities or attributes of (electronic) media are not to be described in purely technical terms, but rather in terms which are meaningful in the framework of education. With regard to networks and educational communication capacities these could read as follows (Figure 5):

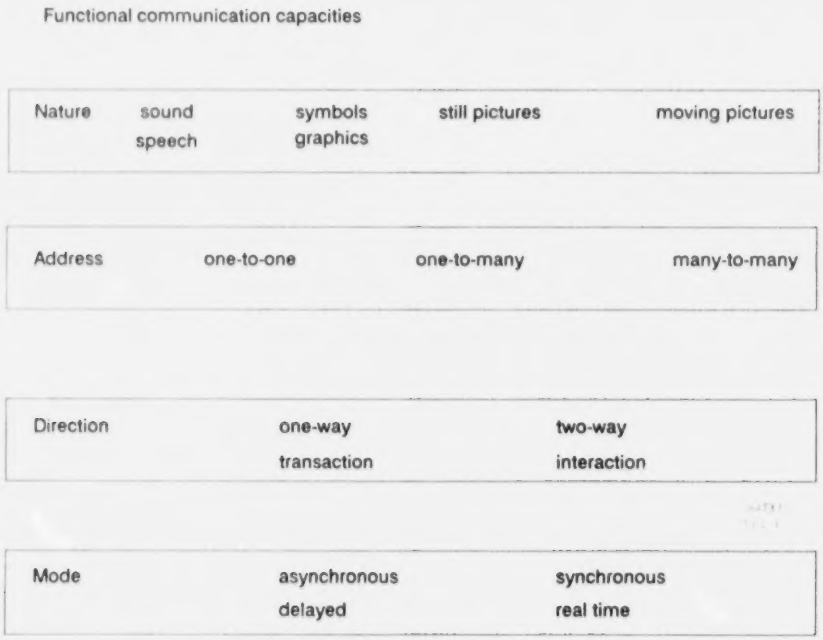


Figure 5

And, of course, the meaningful combinations of these.

The actual process of choosing specific media and combining these into a media-mix however does not only take into account media-capacities like those mentioned above, but a far more comprehensive set of educational and practical variables, including cost. It is perhaps interesting to note that is at least a basic relationship between the evaluation (not; calculation!) of costs and the main reason for which a medium has been chosen. If this reason primarily refers to (very) specific properties of that medium, the cost can only be weighed against benefits - if possible. If the choice for the medium concerned has been predominantly for reasons of preference, the cost can be matched against that of alternative solutions, provided they can be all seen as effective. In fact, in such cases the relative cost is the primary reason for the actual choice.

It will be clear that the choice of media and their actual functionality in education and training in the end can only be justified in view of concrete situations. Or to turn the argument around; that provision of a specific medium or an infrastructure on a larger scale, e.g. an electronic network, without thinking about functional applications would create a risky situation. To summarize: educational "media" do not so much refer to physical means, but rather to media-applications. This is also applicable to media for communication.

- Educational media (for communication) can be used either for their specific possibilities, or as an alternative solution (added value versus preferential value). This has different implications regarding cost.
- The actual use of educational media (for communication) can only really be justified in terms of concrete applications, where the total situation is dealt with in an integral fashion.

Application

From the point of view of distance education and training, there are many situations in which a communications-network could provide a functional solution, in the sense described above. But as stated above, the final judgement on that must be based on a number of variables, and stated as concretely as possible.

Nevertheless, I propose a slightly more abstract example, to illustrate the kind of reasoning. This example builds on network-capacities of a relatively advanced and specific nature, not yet even available generally, but which should nevertheless primarily be justifiable in terms of preferential value. By consequence, also a cost-comparison should be possible and favourable. This example can be discussed as follows.

Student support at a distance

In most higher level, profession-oriented areas of education and training interactive computer usage has become a vital or even crucial prerequisite. In many case this takes the form of powerful, complex and sometimes highly sophisticated interactive instruments for computer aided design, computer aided manufacturing, dynamic simulations and process control, and so on.

To be mastered, the use of these instruments has to be taught and trained, by instruction and exercise. For this, well-designed manuals, clever assignments and proper feed-back on these are clearly needed. In a traditional teaching or training situation, the latter very often takes place in group sessions under the personal guidance of teachers and trainers.

In distance teaching and open learning situations, with emphasis on individual selfstudy, the traditional approach is not viable. Even very good manuals and work books cannot provide the individual feedback and help needed. To provide these in a truly flexible and adaptive way is (very) expensive and time-consuming.

A solution for this specific problem of teaching and training at a distance could be offered by the availability of an advanced electronic network whenever and wherever needed. In such a situation students work through their printed manuals and start their interactive assignments on an individual basis - at home, at work, or even on a campus. In need of study-help, they can (auto-dial from their personal computer, into a network connection with some remote teacher or trainer. At the moment of connection both will have on their screens the interactive application with which the student has been alone, so far. Communication is by voice, while problems are indicated and help given by simultaneous or alternate manipulation of the same interactive application. Once the help is given and the problem(s) solved, students disconnect and proceed working interactively on their own again. Such an application is a typical integrated use of the ISDN. The system could also be made available on the private speech/data networks used in larger corporations.

If needed or wanted, this type of interactive student support at a distance can also be asked and

given in (virtual) group-fashion, with or without teachers, even on a European scale. The actual physical location of participants is irrelevant, provided that the required facilities are available.

For an educational problem as presented, it would be an adequate and possibly, cost-effective solution. But this does not mean, that all student support in distance education should take this format, or that the required infrastructure should be implemented and used "regardless". Or in other words: it would be wise to develop and scale both infrastructures and applications in a balanced way.

Conclusion

Before reaching a final summary-statement, a few words on the delivery aspect as mentioned in the title of this presentation.

Generally speaking, the term "delivery" either refers to the transport of information or applications as such, or to a more comprehensive didactic concept in which personalized teaching situations, e.g. virtual classrooms are implied.

In the first case, electronic possibilities can be evaluated along the lines of "alternative options", including the systematic consideration of all relevant factors within the educational situation as a whole. In principle, it does not matter which kind of information or application is to be transported.

In the second case, of a more comprehensive meaning, electronic possibilities, both the added value and the preferential value of the medium should be considered for the intended application/situation. Situations like those described in our example require a bit of both, with a final evaluation in terms of preference. Some more new and complex didactic approaches would exploit more of the added value of advanced networks - with all the consequences for financial justification. There could and should perhaps be much more said on these issues, but time induces me to summarize what has been said in the following, final statement:

- In using telematic networks for distance education and training, the best policy seems to be to implement infrastructure and to develop applications in a parallel fashion.
- Infrastructure must be as much mainline, standardized, modular and expandable as possible.
- Applications in communication must be clearly (financially) justified, in terms of well-integrated functionality or in terms of important specific possibilities.

INTRODUCTION TO JANUS

Paul Bacsich, Open University, UK

Introduction to JANUS

The end result of the JANUS project will be to have established a private communications network for use by distance teaching institutions throughout the European Community. This network will use satellite services to provide lower-cost communications.

There are many motives for such a project. The cost of attending meetings to discuss the production of pan-European distance teaching material is large, typically 500 ecu per trip per person, plus the time taken. Financially, there will be many advantages in offering an alternative means of keeping in touch, through the use of Information Technology (IT). furthermore, the design of the system will take into account existing practices at participating institution and with other institutions. There is the commercial potential of adopting the system for business use and of opening up the telecommunications market. These two factors are in line with current CEC thinking with regard to deregulation and competitive open markets.

The JANUS system will provide each participant with access to colleagues, both nationally and internationally. Each site will have access to a shared two-way link which will carry a single voice channel and a number of data links.

The voice channel will be used for one-to-one telephone calls and, with a little adaptation, audio conferencing will be available. The voice channel will also be able to carry facsimile traffic. The data link will support a number of channels that may be used for one-to-one and one-to-many (broadcasting) applications. It will also carry system management information - vital for the operation of the system. Typical data applications are: electronic mail, computer conferencing, document transfer and general access to remote computer installations.

Geographical Locations

The current overall scheme of the JANUS network is that each member of EADTU should have a satellite earth station at its headquarters. This implies earth stations at the sites shown in the Table below:

Open University	Britain	Milton Keynes (near London)
Open Universiteit	Netherlands	Heerlen (near Maastricht)
FernUniversitat	Germany	Hagen (near Dusseldorf)
DIFF	Germany	Tubingen
Jysk Aabend Univ	Denmark	Aarhus
Dublin City Univ	Eire	Dublin
STOHO	Belgium	Brussels
FIED	France	Paris
UNED	Spain	Madrid
Univ Aberta	Portugal	Lisbon
CUD	Italy	Rome
NKS	Norway	Oslo
SADE	Sweden	Stockholm

This list is not necessarily complete. Other organisations may ask to join. Several members of SATURN are interested.

Note that most countries of Western Europe have an EADTU member. It is to be expected that more countries, including those in Eastern Europe, will want to join in distance education and training activities. Thus the coverage required from a satellite to serve JANUS has to be Europe-wide. (Figure 1).

Level of Integration

The success of the JANUS system will depend very much on whether or not it is well integrated with the systems that authors use from day to day. What is meant by an integrated system? As an example, suppose that an author in Denmark needs to talk to an author in Germany. In a poorly integrated system, the author might have to reserve a time when the conversation can take place, or have to go to a special room at the other end of the campus. Human nature being as it is, a poorly integrated system would soon cease to be used. In a well integrated system, the author in Denmark would simply dial a telephone number to make the connection; setting up the call would be much the same as an ordinary call.

It is easy to visualise a well integrated voice system; we use the telephone every day, and can see the characteristics that make it easy and efficient to use. The telephone service is reliable; there are no restrictions on when it can be used; the same procedure is used to make a connection regardless of the destination; a single telephone apparatus can communicate with all other telephones; a single telephone apparatus can communicate

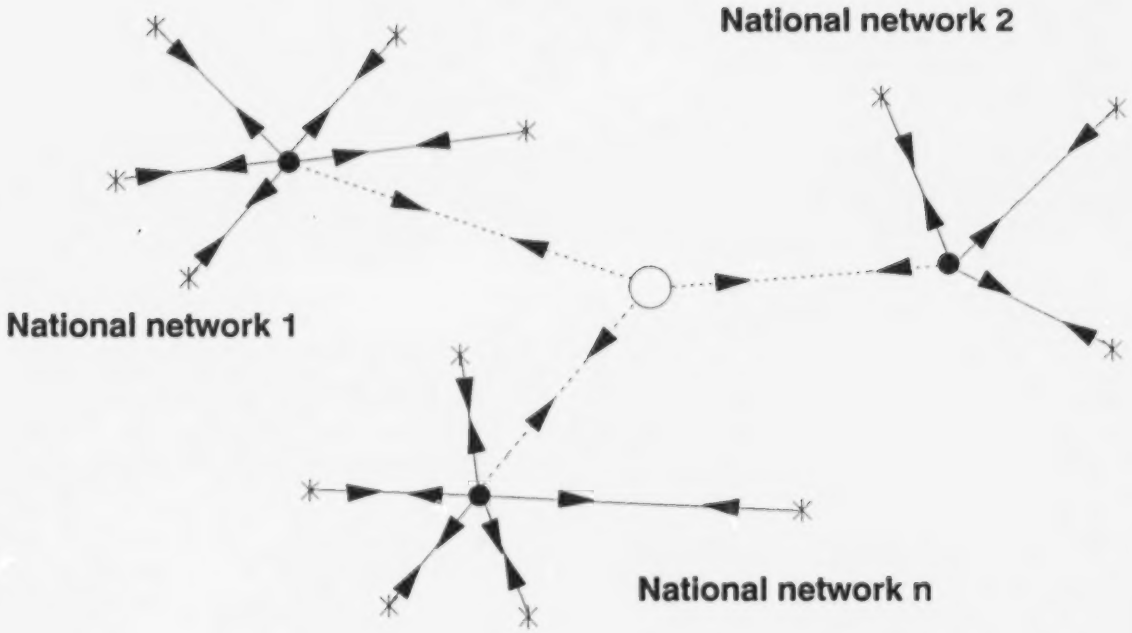

National network 2
National network 1
National network n
Janus microterminal
Satellite
Individual user (students)
Local / national terrestrial data link
Propagation path to satellite

Figure 6

with all other telephones, etc. We have indicated just a few of the characteristics that justify the telephone system being called well integrated. Note that these are characteristics that a user would encounter. However, implementing such a system in JANUS is much harder - it must not be forgotten there are many technical details that have to agreed and technical difficulties to be overcome before such a system can work.

The problem of integration for data communications is more complex. There is no single equivalent in data communications to the telephone system - we use electronic mail, computer mediated conferencing, file transfer, and a variety of different computer terminals, computer networks, software. Many of these systems are fundamentally incompatible. However, implementation of an integrated system in JANUS is possible for a subset of data communications requirements.

In order that good use is made of the JANUS system, it must be well integrated with the communication facilities that exist at present, for both voice and data services. In other words, the introduction of JANUS must create as little disturbance as possible to the existing communications environment at each location. One of the secondary benefits of integration in this manner is that the cost is kept down, if this aim is accomplished, then there should be no need to install special workstations or to devise training schemes in their use.

Organisation of the Project

The JANUS project partners (active in this phase) are:

- EADTU, as the UK Open University and the Jutland Open University
- Marconi (UK)
- Dida*El (Italy)

The master contract for the JANUS project was agreed early this year. It has a contractual start date of February 1, 1990 and a running period of 15 months; thus the contract finishes on May 1, 1991. The project organisation is Marconi as sole contractor, subcontracting to the EADTU and Dida*El. EADTU in turn subcontract to UK OU and Jutland OU.

Outline Conclusions

Though only a few months into the formal phase of the JANUS project, the timescale is over one year into DELTA, and hence we feel it is appropriate to try to draw some conclusions from our work so far.

- The JANUS project is likely to prove feasible, given the expected trends in technical and (recently) in regulatory matters. Costs still need to be calculated and this requires more detailed design work than we have done so far.
- Out of the range of available European satellites, we have identified three satellites that are potentially relevant to JANUS-type networks: disadvantages, and the choice factors are fluid: currently Eutelsat seems to be the best option.
- The concept of JANUS as an "overlay" network is not feasible, largely on human factor grounds (though never really stated explicitly, there was an implication in some early JANUS planning that the JANUS network would be separate from existing terrestrial provision). The JANUS data network must be integrated with LAN and WAN facilities at the user sites and must deliver service to the workstation normally used by the users' staff, with as little visible additional software as possible.
- We have identified a number of ISO, CCITT and industry standards which together make it much easier to build the JANUS network. These include:
  - IEEE 802.3 Ethernet for Local Area Network.
  - CCITT X.25 for Wide Area Network.
  - CCITT X.400 for interconnection of e-mail systems.
  - ISO 8879 SGML for structured documents.
  - PostScript for graphics.
- The problem of multiple large European character sets is soluble (even if extended to East Europe and USSR), although the available and prospective solutions within existing mass-market commercial packages are not ideal.
- There is still limited use of and interest in current communications-based systems from staff in members of the initial user base for JANUS. Possible barriers to adoption have been identified. JANUS can be designed to overcome these barriers, provided that the users maintain institutional commitment.
- The software solutions for cooperative authoring are few in number, limited in

scope, expensive, and not integrated with the mass-market products which most IT-aware authors use. this problem will require integrative software utilities.

- The initial client base for JANUS is fairly mainstream in its requirements and so we expect that a JANUS network will have much wider applicability to organisations and consortia wishing to reduce communications costs between sites.
- JANUS-type networks can have applications to the teaching of students and distribution of courseware as well as to the creation of courseware.

Widening the Scope of JANUS

In this section we discuss several issues which are formally outside the scope of the current JANUS Feasibility Study, but which nevertheless crop up, especially in the context of questions and requests for further information on JANUS. These issues are:

- Extension of the JANUS network to other education and training sites.
- Use of the JANUS network for teaching, perhaps in the context of the "European Electronic University".
- Use of JANUS-type networks in Eastern Europe.
- Use of JANUS-type networks for business applications, such as technical writing.

The following sections go into the topics only briefly. If we had to explore any of them in much greater detail, an additional study would need to be done.

Extension to Other Education and Training Sites

From the time of the earliest discussions on JANUS, it was seen as not necessarily exclusive to the EADTU. Indeed, in the first proposal (for the full network implementation), it was envisaged that the Italian training provider ISFOL would have been a participant. The current position of the EADTU, and JANUS project, was recently summarised in a submission to CEC called "Electronic Networks for European Distance Teaching and Training" (members of the JANUS project contributed to that document). In that, it was stated as general policy:

"We also recognise that although such an infrastructure is of central interest to our association (EADTU), its scope is much wider than the "core business" interest of the EADTU and its members - for example, in relation to vocational and professional training. Fortunately, in general our links with industry are good - on a bilateral basis for a number of our members; through cross-membership with SATURN; as well as through an agreement with EuroPace."

With particular reference to JANUS, the document went on:

"At present, a Joint Academic Network Using Satellites (JANUS) is the subject of a feasibility study as proposed by EADTU in the framework of DELTA, and recently approved by the executive committee of the latter. Its purpose is to prepare for the infrastructure needed to link up, of voice and text-data communications, European institutions wishing to work together to produce, jointly, distance teaching materials for delivery on a European-wide basis and wishing to transfer credits between institutions. The plan is to develop and install relatively low-cost, narrow-band, two-way earth stations (microterminals) at initially about 12 distance teaching institutions. These will be used for voice and electronic data communication between institutions, including audio teleconferencing and computer conferencing."

Related to the project proposal a calculation was made which shows that even with a relatively modest number of participants and production activities, such an enterprise can be cost-effective. In fact, the EADTU itself is already preparing for cooperation in course development in four European subject areas: Business Administration, Law, History, and Language Teaching.

Although JANUS is initially oriented to the needs of EADTU members, such a network should have considerable value to a larger community of users, such as the larger industrial members of SATURN, and some other universities and training providers.

The observations are particularly relevant at this time when joint course development involving EADTU together with other agencies is being discussed in the framework of COMETT II.

One should also note that our survey indicates that the internal computing and communications environment at EADTU members is relatively similar to that found in many large corporations and

other universities. Thus although some JANUS services will need to be "tuned" to the needs of EADTU, for other services (e-mail, file transfer, work processing, voice links, etc) EADTU is turning out to be a relatively "mainstream" client.

Size of the JANUS Network

Some preliminary calculations suggest that with a traffic pattern for data similar to that expected between EADTU members, the JANUS network could support up to 100 microterminals. Thus for example, this would allow (the larger) organisations who are part of federations in EADTU to have their own JANUS microterminal, or multi-site organisations to have a microterminal at each site.

If the number of potential JANUS users grows beyond that, there is no technical problem in setting up additional JANUS networks. The best approach might be to set up JANUS-type networks based on natural communities of interest.

We have not studied the issue of interconnection between JANUS-type networks. It is not difficult to provide interconnection at the X.25 level of data services.

Student Related Aspects and the European Electronic University

Among the services offered by JANUS are Computer-Mediated Communications (sometimes called computer conferencing) and audio teleconferencing. These have been used effectively in other contexts for distance teaching, and there is every reason to expect them to be useful to JANUS: indeed, more useful because constraints of cost and line quality will have been removed. It is also likely that since the course material developed under JANUS will be in electronic form, there will be interest in using JANUS to distribute the final versions of course material as well as the drafts. For low-population courses, these final versions could then be printed locally n high-speed laser printers.

This means that whoever has a JANUS microterminal can "tap in" to the JANUS network for training purposes. Although initially the JANUS network will only reach the sites of the EADTU members, this reach could already offer a useful amount of training, particularly in those subjects where EADTU has a lot of corporate (but distributed) expertise, such as in the training of distance educators.

However, the cost of the JANUS microterminal is designed to be affordable by larger universities and training organisations, and so many other sites could be added. A succinct description of the advantages is given in the aforementioned EADTU paper:

> *"The application of voice, data and text information is of equally great interest to the Distance Teaching and Learning Configuration. Permanent telephone connections which are quickly available, and relatively low-cost, between staff (academic, administrative, mediary) and learners, and between staff at different sites, are urgently needed as an everyday necessity. So are data networks to supply access to electronic data bases and provide data and text transfer for assignment exchange, tutorials, cooperative problem-solving activity, and so on (using electronic mail, electronic publishing, and computer Mediated Communication)."*

JANUS provides all these facilities.

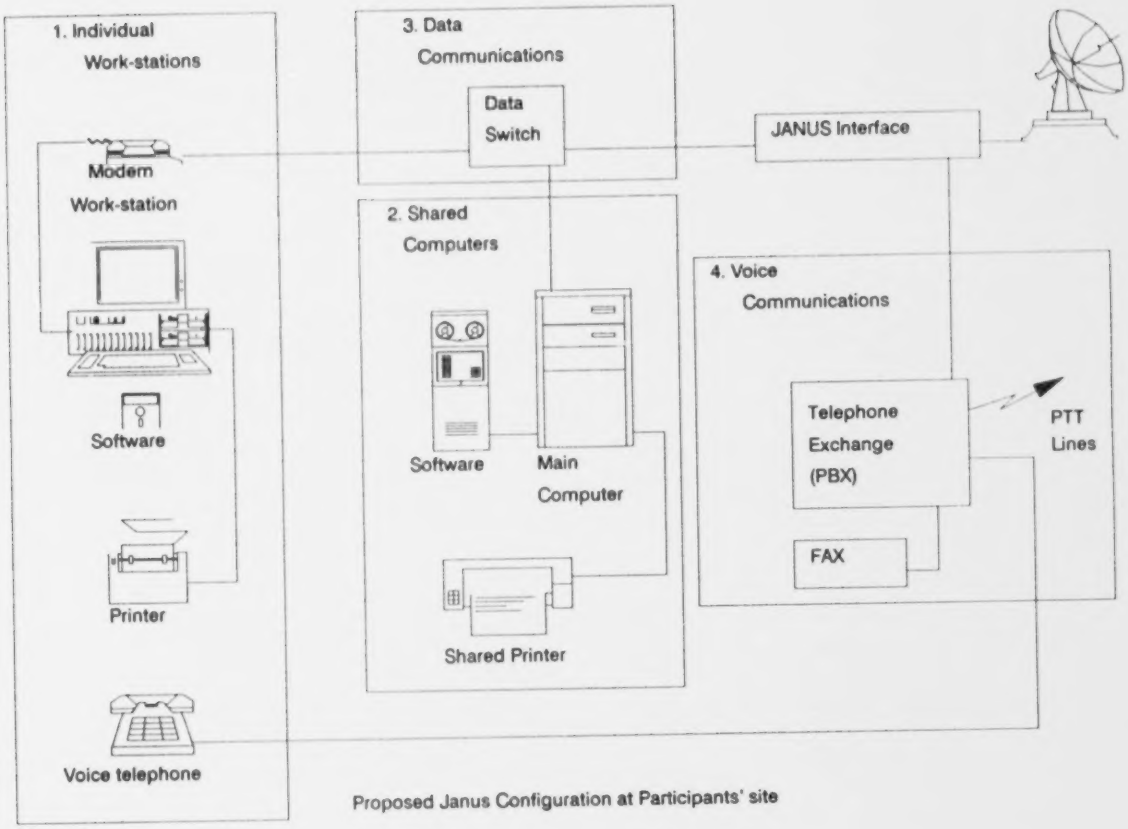
Video

There is one function that JANUS microterminals do not provide as currently envisaged: video. However, a preliminary analysis suggests that a one-way video capability could be added relatively inexpensively to JANUS microterminals. This would allow a richer set of educational experiences: for example, activities like broadcasting with an audio teleconference (or computer conference) after the broadcast. A further use of the video channel, for example overnight, could be for data broadcasting.

Data Broadcasting

This leads on to another augmentation to the JANUS concept that we have spoken about at various meetings. The point-to-multipoint nature of JANUS lends itself to many information distribution applications for the EADTU (and whoever else has a JANUS microterminal). We envisage that drafts of course material should not also be distributed like this. We also expect that the type of CMC system we install will be distributed, with updates to conferences flowing over the JANUS network, from the one originator of the update (an update could be a new message, a comment, etc.) to the many subscribing recipients.

Since this mechanism will be set up anyway, it is not difficult to send a selection of this material also as a data feed to a data broadcasting service. Such services allow very cheap (but receive-only) earth stations to receive data transmitted over a satellite (often using all or part of a video channel).



Proposed Janus Configuration at Participants' site

Figure 7

Such earth stations are normally designed to receive video also.

These receive-only earth stations would form a sort of 'outer fringe' to JANUS. They might be particularly useful to deploy at study centres and SME company training locations.

Eastern Europe

In common with many projects, the JANUS project was set up before the changes took place in Eastern Europe. In common with many projects, Eastern Europe is not within our brief, but cannot be ignored.

It is worth nothing that the exact range of countries that the JANUS project covers is something more than CEC countries anyway, since EADTU has members in Norway, and now in Sweden.

Within the JANUS project, we have taken the following approach to information gathering and analysis regarding Eastern Europe:

- Where it was no harder, or in some cases easier, to collect information relevant to Eastern Europe, we have done so (for example, satellite coverage maps, character sets).
- Where it was easy to do so, we have made contact with other development activities related to Eastern Europe (for example, the UK OU has developed a PostScript typeface to allow East European accented letters to be typeset).
- However, the only analysis done of Eastern Europe is the small amount done here in this Interim Report.

We present somewhat tentative conclusions in two areas:

- JANUS microterminals could be placed (technically) in much of Eastern Europe, since it is covered by satellites of interest to JANUS.
- There are no conceptual problems with character sets used in Eastern Europe (including Cyrillic) - they are all included in the ultratext database. However, further information would need to be collected on local standards for character sets, and further conversion utilities developed.

Satellite Coverage

Eutelsat

The typical superbeam coverage provides an EIRP of 52 dBW at the centre, falling gradually to 44 dBW at the outer regions of Europe as well as over the northern strip of Africa. The 50 dBW contour encloses the central parts of Western Europe, as well as East Germany, west Poland (Poznan, Wroclaw), and western Czechoslovakia, Hungary, and the northern half of Yugoslavia (with Belgrade just beyond).

The east wide beam coverage provides a 44 dBW EIRP to almost all of Western Europe and most of Eastern Europe. Poland, Czechoslovakia, Hungary, Bulgaria, Yugoslavia and the Baltic republics are within the 44 dbW contour. Romania is half in, with Bucharest right on the contour. The 39 dBW EIRP contour allows a further extension of the coverage to North Africa and the Middle East. Moscow is just outside that contour; but Leningrad, Kiev, Odessa and the Black Sea and Caucasus regions are in it. (Fig 8).

Figure 8

ASTRA

The Astra satellite is often thought to be aimed at the industrial heartland of Western Europe. This is not really true. The coverage of the beams vary a little: we shall take Horizontal Polarisation Mode 2 as an example (this is used for example for MTV Europe). The highest power contour, 52 dbW, covers all of East Germany, and the western quarter of Czechoslovakia including Prague. The 46 dbW contour, needed to enclose Naples and Lisbon, covers almost all of Poland, Czechoslovakia, and Hungary.

Olympus

Here we are talking about the specialised services payload, since this is the only one suitable for JANUS (see above). The five-beam array of circular spots has a spot "C" which in standard position is centred on northern Yugoslavia and covers most of Czechoslovakia (with Prague on the edge), southern Poland (Krakow), Hungary, the western edge of Romania, and the northern two-thirds of Yugoslavia.

General Business Applications

Many technically-oriented companies (especially in the computing, communications, and aerospace areas) have major problems with the creation of technical manuals for the European market. A cooperative authoring system could be very beneficial to them. The JANUS network allows them also to reduce the communications costs of using such a cooperative authoring system.

More generally, any major company with widely dispersed large sites across Europe will be tending to look at VSAT networks as a possible solution to at least part of its communications needs. JANUS, as the first mesh VSAT network, should be a good match to their requirements.

Use for Learning

- JANUS offers Computer-Mediated Communications and audio teleconferencing, without constraints of cost and line quality, to up to 100 sites
- JANUS can distribute the final versions of course material as well as the drafts. For low-population courses, these final versions could then be printed locally on high-speed laser printers
- Even if the initial reach of JANUS is only the sites of the EADTU members, this already offers a useful amount of training, particularly in those subjects where EADTU has corporate expertise
- Video can be added to JANUS microterminals
- Since JANUS has internally a strong point-to-multipoint component, it is easy to link JANUS to a "conventional" data broadcasting system (on the TV scan lines), for distribution of:
- Drafts of course material
- Final versions of course material
- Updates to CMC conferences to the many subscribing recipients

Extension of JANUS Scope

- Extension of JANUS to non-EADTU sites raises few technical problems but some institutional issues
- Some discussions on the student-related aspects of JANUS-type networks have been and are being held in EADTU circles under the general umbrella of the "Electronic University"
- We are actively investigating the extension of JANUS-type networks to Eastern Europe
- The business-oriented aspects of JANUS are part of our exploitation strategy

Outline Conclusions

- The JANUS project is likely to prove feasible, given trends in technical and (recently) regulatory matters
- Three European satellites are relevant to the JANUS network:
- Olympus, Astra and Eutelsat
- The concept of JANUS as an "overlay" network is not feasible, largely on human factor grounds
- We have identified a number of ISO, CCITT and industry standards which together make it much easier to build the JANUS network
- The problem of multiple large European character sets is soluble (even if extended to East Europe and USSR)

JANUS Concept

- Shared two-way link which will carry one voice channel and several data links
- Voice channel:
  - one-to-one telephone calls
  - audio conferencing
  - facsimile traffic
- Data links:
  - one-to-one and one-to-many applications
  - system management information
  - electronic mail and computer conferencing
  - cooperative working
  - document transfer
  - access to remote databases

DEDICATED - Development of a new Dimension in European Computer-Aided Teaching and Education

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Abstract

The development of a new dimension in European computer-aided teaching and education - DEDICATED - is a R&D-proposal aiming at the promotion of institutional cooperation on a European scale in the areas of distributed, multilingual and multimedia education, continuing education, and industrial training.

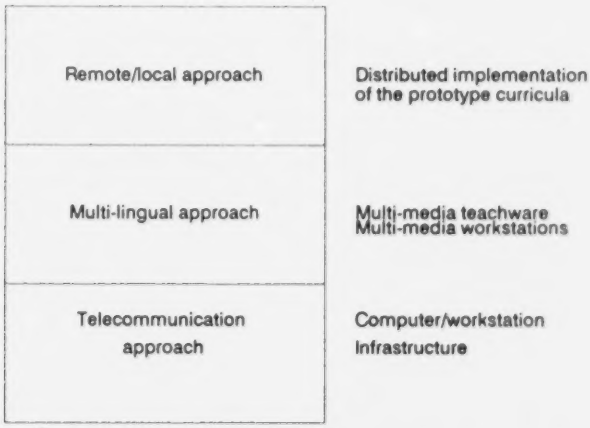
It is one of the project's main goals to develop collaboratively training tools and software.

DEDICATED should have as results:

- profiles for the (hardware, software and system) needs for a European academic education and training scheme
- implementation of a European academic educational scheme on a local/remote basis (telecommunication approach)
- tools for the development of multilingual teachware
- tools for the support of multimedia approaches
- prototype education and training programs for computer science and engineering, demonstrated on courses given by the partner institutions
- prototype training programs for small and medium-sized companies.

Introduction

It is important to think of progressing education, training, and learning on a European scale in particular since the integration of the European Community is progressing rapidly and will be even stronger after 1992. An integration from a market point of view - and education and training, even if basic, academic or post-professional is a market by itself - needs joint educational and training programs and the development of new educational and training structures and concepts. In a European dimension this market should be served by a computer network infrastructure, an integrated "local/remote" information system and a "multilingual" teachware approach.



The DEDICATED three-level approach

Figure 9

The DEDICATED concept and functional framework was developed on the already existing co-operation in education and training between Germany and Portugal:

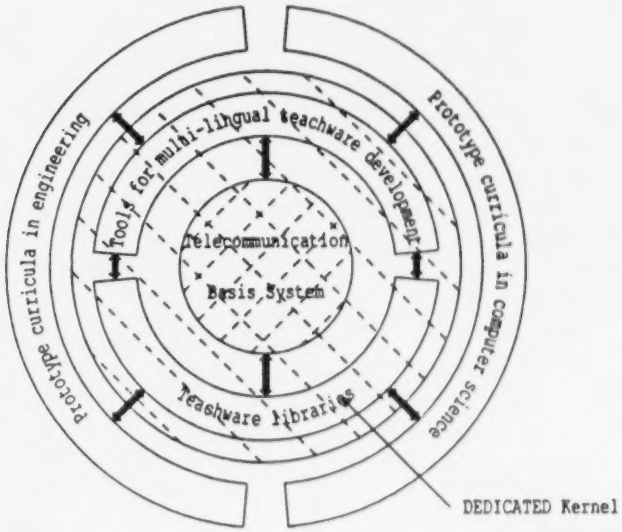


Figure 10

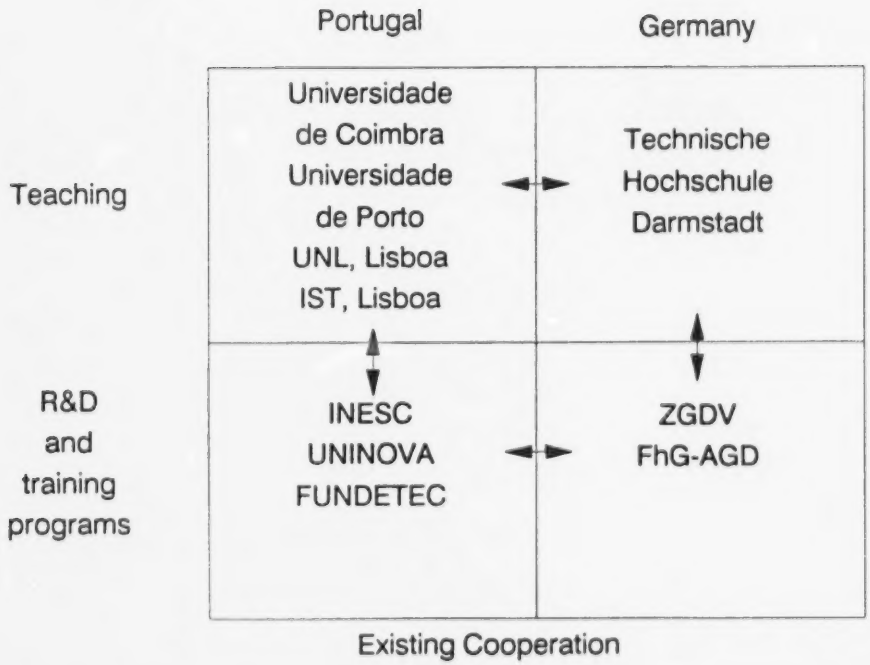


Figure 11

In addition to these Portuguese partners within DEDICATED cooperation is to be developed with further European universities and R&D groups just as hardware and software manufacturers, software and systems houses and commercial developers of teachware and teaching systems, as well as with small and medium-sized companies acting as user constituencies and as demonstrators for project results.

1. Networking

1.1 Introduction

A European educational and training program among several institutions in different European countries as aimed by DEDICATED has to support the following demands:

- The educational and training framework won't be implemented only in a central institution, but in combination of local and remote courses in order to minimize travelling outside the home country.
- The basic educational and training information has to be multilingual since it cannot be expected that all students only use English as their educational language. Since DEDICATED expects European education and training to be multilingual in the future the related teachware has to be considered also from a technical aspect (teachware post- and pre-processors for several languages, translation platforms, etc.)

These two points ask for a telecommunication infrastructure serving a multimedia information system and multimedia workstations. For this reason we will have to provide various kinds of telecommunication services which could be handled easily, e.g. messaging, conferencing, and E-mail.

Darmstadt has already been working on the DEUKOM-Program (Darmstadt-Europe-oriented program for communication technique) aiming at a multimedia, telecommunication infrastructure.

DEUKOM therefore could serve well as a basis for this development in Germany.

In the other countries local infrastructures being similar to DEUKOM will be used or will have to be developed.

1.2 Network Infrastructure

1.2.1 The Local Topic Centres

Building such a distributed system asks for a complex management that fixes and coordinates the distribution of tasks and responsibilities.

The DEDICATED network basic building blocks are the so-called LTCs (Local Topic Centres). They are the nodes of the network which hosts the activities.

An LTC covers specific knowledge in various teaching areas (e.g. mechanical engineering, computer graphics, computer aided design, etc.) and is the basis for the development and delivery of educational and training software as well as the support centre for running the courses.

1.2.2 Connection between different LTCs

DEDICATED does not focus on the development of new technologies but on the usage of existing ones. Connecting LTCs through the whole EEC prohibits the use of expensive networks and high bandwidth networks being not available in general.

Altogether, in spite of the fact that X.25 is available now and special digital links are available as well (e.g. Lisbon-Stockholm) the connection between different LTCs is still an open question since the bandwidth of X.25 is not at all sufficient to support multimedia applications and the special digital links are only special solutions to connect two partners point-to-point.

1.2.3 Connection inside an LTC

Inside an LTC the connection should be realized via a LAN: Ethernet or FDDI.

From a teachware point of view the network should provide a configuration of PCs or workstations to establish an electronic classroom in the following way:

- All users can work independently
- The teacher can broadcast his screen contents to one or more students
- One student can temporally act as the teacher
- Screen displays can be switched between any combination of systems
- The teacher can control the input devices of one or more students

1.2.4 Compatibility between LTCs

Since there will be heterogeneous LTCs in DEDICATED (it is not the program's intention to have a uniform basis in every country) several levels of compatibility have been identified: operating systems, window systems, toolkit and user interface. Special attention should be paid to the realization of the same "look and feel" and the ease of porting.

2. Support Tools

2.1 Introduction

It is essential that learners can concentrate intensively on the learning process without being distressed by operational activities. The proposed support tools will harness the operating environment to specific learning requirements in terms of:

- Man-Machine Interface
- Access and Usage of Learning Materials
- Communications
- Dedicated Learning Facilities

2.2 Man-Machine Interface

The Man-Machine Interface (MMI) will be built on top of the state-of-the-art Graphical User Interfaces as a dedicated user interface for learners.

Such an interface will create a synergy between different learning environments and should facilitate the use for learners and tutors.

The MMI will provide the fundamental link between the student and the learning environment with the aim to shield the student from the particular environment idiosyncrasies and to provide him or her with a unique working environment that will always present a uniform functionality and a look and feel which is independent from hardware platform, operating system, and windowing system.

Furthermore MMI functionalities should allow:

- students to navigate on learning sequences and their previous activities
- access to simulation and/or demonstration applications (local or remote)
- the support and extended usage of such inputs and outputs as "dial base", mouse, keyboard, 3D glove (data glove), sound, etc.
- usage of extended outputs (e.g. voice output) provided that the specific hardware/software platform supports it.

2.3 Access and Usage of Learning Materials

Since DEDICATED aims at the development of an environment for flexible and distance learning, a common data base supporting various kinds of access and different kinds of usage must be designed and implemented.

For developing a distributed system a connection to a distributed (or remote) data base is necessary.

The learning material data base will support an identification mechanism combined with different levels of access rights. The modification of learning material can be restricted to course developers only.

2.4 Communications

The following set of interactive links should be guarantied:

- Teacher-class interaction
- Teacher-learner interaction (in particular the teacher should be able to monitor the students' work)
- Learner-learner interaction
- Learner-server interaction

A long term goal is the development of a video-conferencing tool that will provide visual contact between the teacher and the students when they are not physically in the same room.

2.5 Dedicated Learning Facilities

We will take into account both support tools for the learning process and support tools for the teaching process. Learning facilities like journal files (they especially store the learners' activities), lessons, and slide sequences are already used.

We think of improving help functionalities by using multimedia tools that will even support the learning process itself. If a student asks for more information about a special context starting a certain program (e.g. a video or a simulation program) could help him to grasp the problem.

Since one of the purposes should be to support the user more individually and with respect to his knowledge and experience we should discuss the usage of tutoring or even "intelligent" tutoring systems (ITS). Whole sections of the learning material can be presented on the computer while other sections can still be defined by an instructor.

When preparing a computer-based lesson we have to take into account that the "author" is a subject matter expert but a novice on the computer. We therefore have to provide tools to support him in working out the adequate instruction material.

3. Teachware and Course Development

3.1 Introduction

In discussions and meetings people talk about education and training the terms "Teachware", "Courseware" and "Educational software" are used synonymously.

We consider these terms as synonyms as well with the slight difference that "Teachware" is the term being preferentially used in Europe while "Courseware" is more common for the American usage. Our understanding is based on the following statements drawn from /EbBr-88/:

> *"Courseware is the special purpose software that is authored by a subject matter expert or a computer programmer to provide the instructional interactions".*

This can include a magnetic type, a hard disk or a floppy disk which contains the courseware code.

3.2 Teachware Development

We have to prepare different types of teachware since there are different requirements and demands for specific kinds of teaching like classroom work (traditional lessons), group work (students can contact both - the teacher or another student), or self-learning (no teacher has to be present).

The teachware that is used in DEDICATED will be developed at the LTC in cooperation with the universities and training institutes which supply the technical expertise on the topic.

3.3 Guide-lines for Evaluation and Certification

The Guide-lines should guarantee uniform modes of evaluation and certification in all the European countries that possess an LTC to uniform the LTCs activities greatest possible.

Several evaluation modes are thinkable:

- global evaluations passed at the end of a course
- evaluations involved in the teachware (continuous tests and direct corrections executed by the teachers)
- "on-line" evaluations based on the above mentioned journal files. This mode has not yet been sufficiently explored but should be taken into account in future research.

The evaluation mode can be influenced by further conditions like the teachware subject matter, the course levels (implying different qualifications), the course duration, the way the course is implemented and the course mode itself (lessons, self-learning, group work, etc.)

These facts should be inferable from the certification. The certifications should be made out by the LTC being answerable for the corresponding teachware and only in acceptional situations by another LTC which is explicitly authorized but of course controlled by the responsible one.

Certifications can be given in presence or at distance which means that students can pass their examinations by visiting the LTC being responsible for the teachware subject matter or that students can be tested in their home countries and the tests are sent to the LTC that created the test and is allowed to draw the desired certifications.

Evaluation and certification in presence should be preferential (besides they are economically irresponsible) and even obligatory for courses attended for acquiring a certain degree of qualification (e.g. graduation, master) or qualifications for particular sciences (e.g. medical sciences, jurisprudence, etc.).

4. Organization and Management

4.1 Responsibilities

An LTC is run by at least three people:

- a local project leader, a technical manager, and an educational manager.

The local project leader is responsible for the LTCs running. He will implement the local actions derived from the overall DEDICATED workplan and will ensure the liaising with the other LTCs of the DEDICATED network as well as with the European Commission. Furthermore the local project leader will maintain the contacts with industry like manufacturers of hardware and software, service companies and industrial applicators.

The technical manager is responsible for establishing, maintaining and supervising the resources of the LTC, such as the computers, networks, and software and support tools. His tasks will include equipment and software acquisition, equipment allocation, maintenance planning and implementation, replacement and software updates, version control, and maintenance of the network services.

The educational manager is responsible for the coordination of the contacts with the local teaching and training institutes and the definition of strategies for integrating DEDICATED in the curriculum and the training programs. Thus, it will ensure that the teachware produced locally, as well as the courses hosted by its LTC, comply with high standards of pedagogical and technical quality and will contribute to the global strategy of DEDICATED in what concerns pedagogy and technical excellence.

4.2 Definition of Platforms and Tools

We suggest to choose UNIX, DOS, and MacIntosh based systems but the participating partners' preferences will be respected as well.

More details about the definition of tools (CASE tools, user interface design tools, hypermedia design tools, etc.) are given in /EnGu-90b/.

4.3 Services

The main services by the LTCs are:

- an infrastructure for the development of high quality teachware, supported by a high level of expertise which is available both locally and through the DEDICATED network;
- an electronic classroom where the courses produced by the various LTCs can be delivered with a high degree of pedagogical and technical quality and with support provided locally and through the network;
- the access to a European network of universities and training institutes which communicate and exchange materials and expertise to constitute a common body of know-how in multimedia course production and delivery;
- the access to a European network supporting programs of student and staff exchange, with continued assistance both before and after the exchange take place;
- the basis for an evaluation of the potential benefits and impacts of a high speed European network of universities and training institutes and for the production of Guide-lines supporting further improvement;
- training programs for small to medium-sized companies.

5. Remarks

Further details and more information about the DEDICATED project can be taken from /Enca-89/, /EnGu-89/, /EnGu-90a/, and /EnGu-90b/.

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Overview of the CAMCE Communication System : a Potential Communication Framework Supporting Multimedia Courseware Development Process in a Distributed Environment.

Marco Carosi, Francesco Feliciani,Telespazio

Introduction

One of the key features of the CAMCE environment is the possibility to develop quality courseware in a distributed context. Basically, two levels of distribution can be defined in CAMCE : the first one is dedicated to support the CAMCE environment at local level, the second one is aimed to provide interconnection on geographical scale among the different local authoring centres.

While at the first level a few Local Area Networks can be envisaged, which have enough capacity (from 10 to 100 Mbit/s) to support the distributed environment, at the second level the existing terrestrial networks, and also ISDN, do not offer a complete set of services necessary for a proper interconnection of the local centres. In the following paper this second aspect will be discussed, giving an outline of the possible solutions that can be supposed in the present state of the project.

Reference Scenario and Geographical Distribution of the CAMCE Communication Network.

In the CAMCE environment, we can assume that two different types of centres are involved in the authoring process :

- the Courseware Production Centre (CPC), where the authors team carries on courseware development activity by means of local and external resources;
- the Courseware Delivery Centre (CDC), which houses the multimedia database accessible from different CPCs.

Due to the high added value attached to a CDC, it is of extreme importance that a great deal of CPCs are involved in the distributed courseware development process. The greater the number of the centres involved, the lower the depreciation rate of the entire system is per involved body. In order to achieve such a target at least a European coverage for the CAMCE system is highly recommended. In this regard, for a typical European country we can expect several CPCs (up to few tens) distributed throughout the country, and one or two CDCs.

As far as the required communication services are concerned, a list is given in Tab. 1. As one can observe, these have been shared into 2 categories (interactive if the service is required by the destination, and distributed in the other case), and for each category types and related link directions have been identified. It is to be noted that such services can be grouped also by their bandwidth requirements : most of them can be classified as low rate or narrow band services, i.e. telephony, data, sound and still images, while the TV full motion service implies a greater capacity utilization.

CATEGORY	CLASSES	TYPE	RATE	DIRECTION
INTERACTIVE	Conversational	telephone	64 Kbit/s	CPC = cdc/cpc
		data exchange	64 Kbit/s	CPC = cdc/cpc
	Messaging	electronic mail	64 Kbit/s	CPC = cdc/cpc
	Retrieval	still images	64 Kbit/s	CDC-CPC
		TV full motion	2048 Kbit/s	CDC-CPC
		data	64 Kbit/s	CDC-CPC
		sound	64kBIT/S	CDC-CPC
		still images	64 Kbit/s	CDC-CPC
DISTRIBUTED	With address	data	64 Kbit/s	CDC-CPC
		sound	64 Kbit/s	CDC-CPC
	Without address	TV full motion	2048 Kbit/s	CDC-CPC

Table 1

Existing Suitable Communication Infrastructure : The Satellite Network as Extension and Integration of Terrestrial Networks.

The wide dissemination of the elements forming the CAMCE distributed environment and the bandwidth requirements of the envisaged services imply some constraints on the relevant communication system.

The typical architecture for such communication system is depicted in Figure 12, where the required communication services are supported in each centre by local networks, and the interconnection requirements are fulfilled by a broadband backbone network.

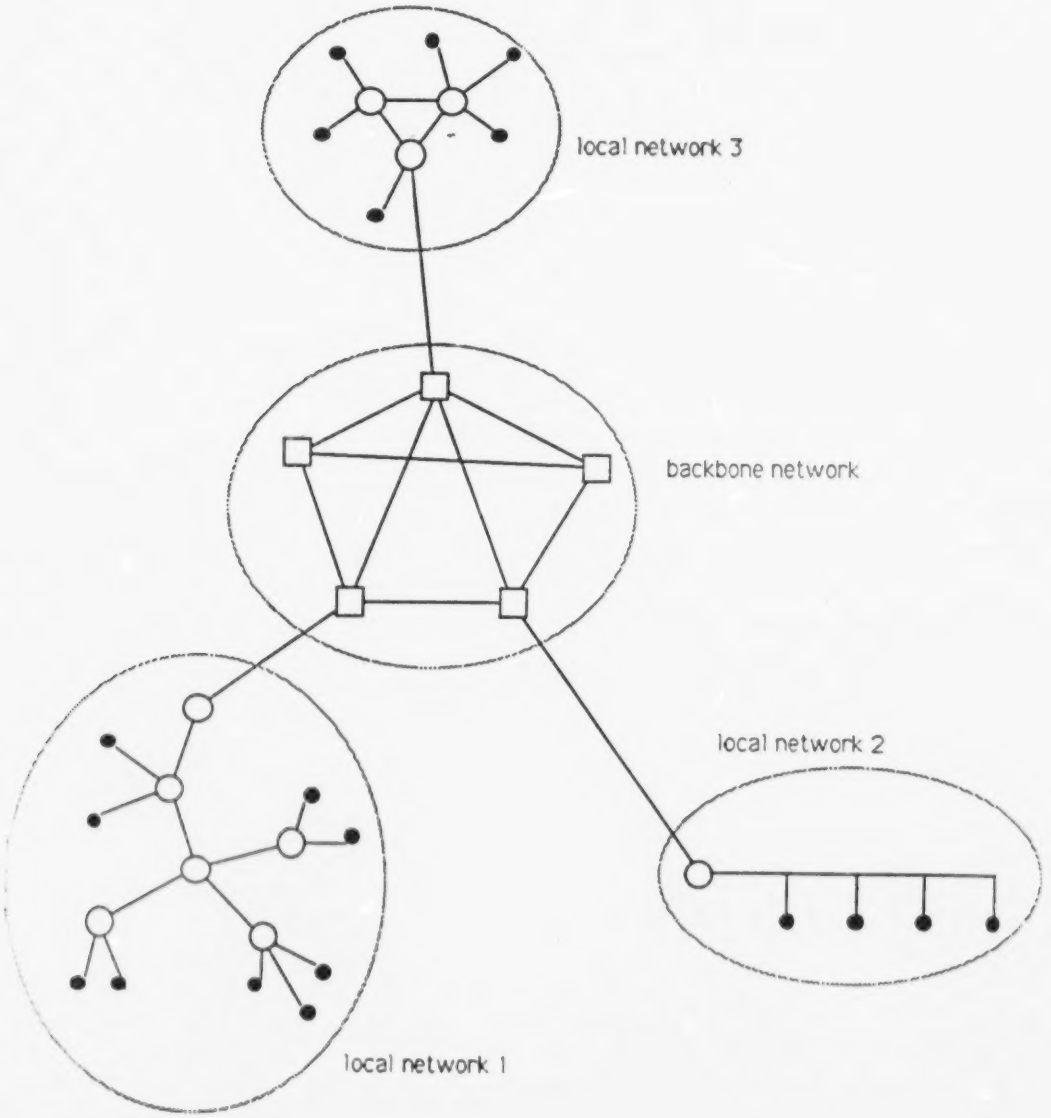

Figure 12

As far as the local centres are concerned, various existing Local Area Networks (LAN) or Extended Local Area Networks (E-LAN) are available, such as Ethernet, Token Bus, Token Ring, FDDI etc., the capacity of which varies from 1 to 100 Mbit/s. At this level, several architectures can be envisaged so as to fulfil the service requirements mentioned above, for instance utilizing only one high capacity network, or superimposing two or more networks each dedicated for a particular service, according to the peculiarity of each constituted connection element.

Concerning the backbone network, at present public networks offer access at low data rate, and even when the incoming ISDN will be available only one channel at 64 Kbit/s will be supported, meaning that the maximum data rate channel supported by a single end-to-end sitching path will be 64 Kbit/s. This implies that the traditional public networks are only able to support the narrow band services for the CAMCE environment. Furthermore no traditional network is capable of offering long-haul broadband connections, while the broadband-ISDN is expected to be operative not before the first years of the 21st century.

From the foregoing a solution other than the traditional networks has to be found in order to provide all the required communication services in the CAMCE environment. Such an alternative could be represented by a satellite network, which is able to support data rate connections adequate for the broadband services of the CAMCE environment, like full motion video.

In this terms, a short/medium solution for the architecture of the backbone network for CAMCE communication environment could be represented by superimposing two communication networks : the ISDN for narrow band services and a satellite network for more bandwidth demanding services. Furthermore the satellite network could also provide ISDN access during the interim development period, when some regions will not yet be covered by the new service facilities.

Overview of the CAMCE communication network

In order to extend as much as possible compatibility with ISDN, for all the services, TV excepted, we have considered 64 Kbit/s data rate channels.

As far as the full motion video service is concerned, a few words have to be spent in order to justify the system options that will be adopted.

Among the several alternatives that can be foreseen, it is important to identify the most suitable solution taking into account the level of quality required by the author during the courseware development process.

Generally speaking, different steps can be envisaged in the process aiming to include parts of TV full motion programmes in the multimedia courseware. In the phase preceding the TV information transmission from the remote multimedia database towards the author's CPC, we can imagine that the author will decide, on the basis of the database contents description, which part(s) of the video sequence he is interested for. This part of the process will be supported by the 64 Kbit/s data rate communication channels.

After this selection, the next step will be the examination of the designated video information. Very likely, in this phase of the author's work the most important feature is to obtain a real time response from the system, without dead time affecting the degree of interactivity between the author and the CAMCE environment. We can expect that for this phase this requirement is far closer to the actual author need than the high quality of the moving video images appearing on the author's screen.

On the other hand, it has to be pointed out that very probably only a fraction of the amount of video information retrieved from the multimedia database will be actually included inside the multimedia courseware, while the remaining part will be unemployed. This fact suggests that is very convenient to save bandwidth occupation by means the reduction of the TV signal redundancy, so as to increase the number of authors that can use simultaneously the CAMCE TV service facilities, obtaining on the whole an improvement of the system performance in terms of real time application.

Adopting a coded TV signal of 2048 Kbit/s data rate (or even less, such as 512 or 384 Kbit/s), it is possible to obtain a satisfactory quality of the video images in framework of the multimedia editing activities.

As far as the final courseware product is concerned, the necessary quality of the TV images can be obtained transmitting from the database the selected parts of the video programs during the night, using an analog FM signal. In this case, the employment of the satellite full transponder for a single TV signal will not affect the real time interactivity of the system, and cost saving of the transponder allocation will be obtained with respect to the daytime operation.

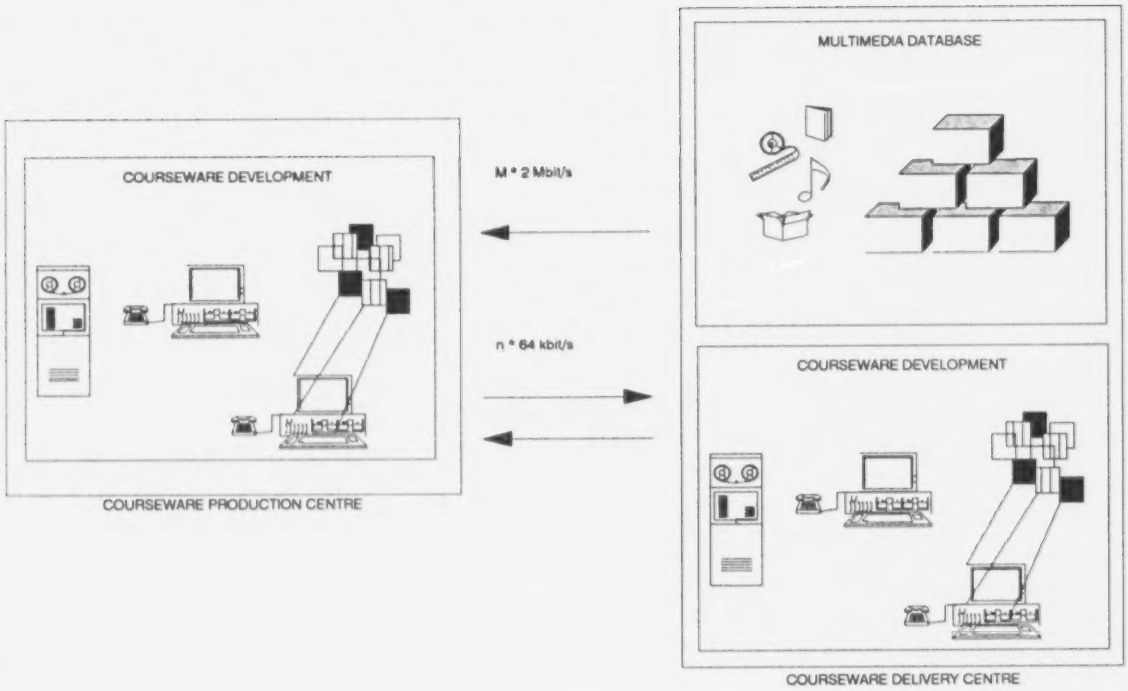
MULTIMEDIA DATABASE
COURSEWARE DEVELOPMENT
M * 2 Mbit/s
n * 64 kbit/s
COURSEWARE DEVELOPMENT
COURSEWARE PRODUCTION CENTRE
COURSEWARE DELIVERY CENTRE

Figure 13

From the foregoing, following the sketch proposed in Fig. 13, the information exchange between CPC and CDC has been assumed supported by the following resources:

- a certain amount of one-way 2 Mbit/s channels from CDC towards the CPC, so as to allow video retrieve operation from the multimedia database during courseware development process;
- a given set of bidirectional 64 Kbit/s channels devoted to provide the remaining communication services.

As to the earth station configuration, it has to be noted that the terminal dedicated to the generic CPC is of the receiving-only type, and therefore it does not require any transmitting chain (which has strong effect in the light of the overall terminal cost). As preliminary solution, the satellite access can be based on SCPC technique (i.e. Single Carrier Per Channel), on a preassigned or a DAMA (Demand on Assignment Multiple Access) basis. An overview of the analysis of the possible solutions will be presented in the next section.

As far as the services based on 64 Kbit/s data rate channels are concerned, we have already mentioned that the simplest solution to support these services is the adoption of the existing terrestrial ISDN facilities. In that case, the general structure of the CAMCE communication architecture is given in Figure 14.

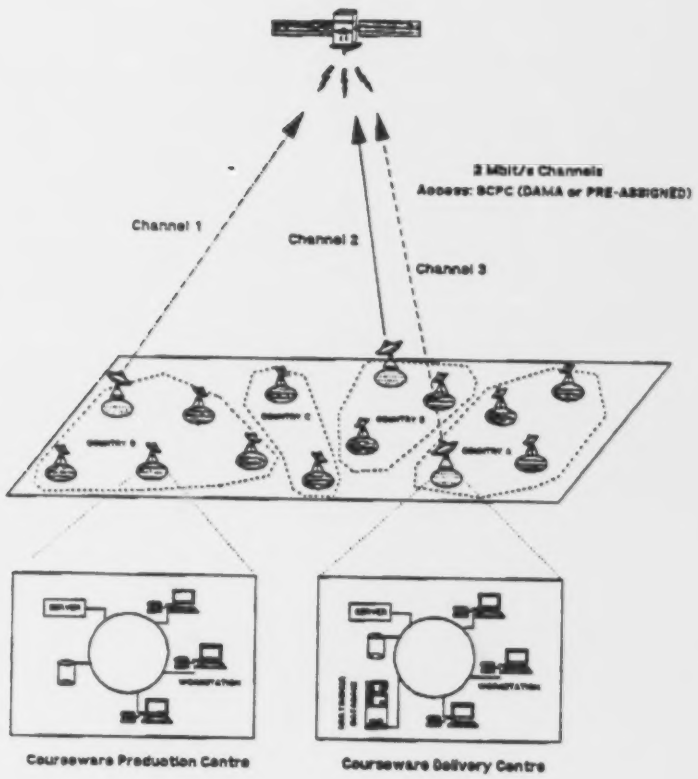

Figure 14

On the other hand, bearing in mind the present status of ISDN connection and its predictable extension in the next years, we should expect a very heterogeneous distribution of ISDN in the European environment. The possible scenarios will be dealt with later.

Basic Features and Possible Configuration of the CAMCE Satellite Communication System.

In order to assure a broadband link connection between any two authoring centres it is necessary to use a satellite system providing a suitable coverage. In other words, the space segment adopted for CAMCE should be capable of "seeing" every authoring centre, regardless its geographical location within Europe.

Generally speaking, the spreading of the satellite coverage is not a free of charge feature, in the sense that for the same power transmitted by the satellite, the wider the coverage, the higher the requirements to be satisfied by the earth terminals are. In the present phase of the project a feasible solution is the selection of a satellite coverage extended to the whole of Europe. On the other hand, more innovative solutions based on multibeam coverage will be disregarded, because they would need a dedicated system configuration very likely not suitable in terms of cost and complexity for the present application.

In addition to the coverage area, another essential characteristic of the satellite network is the frequency band used for the link. The Ku-Band (12/14 GHz) seems to be the most attractive solution for the CAMCE satellite network, because it allows the utilization of small antenna dishes, even thought this frequency band is rather sensible to the rain attenuation.

Among the services provided by the different satellite systems which meet these requirements, a very promising solution in terms of channel allocation flexibility and system simplicity seems to be the adoption of a full transponder dedicated to the CAMCE communication network. With this solution, indeed, the frequency plan can be designed optimizing the allocation of the different channels required by the CAMCE system.

As far as the access scheme is concerned, different methods can be adopted to allow the sharing among several users of the same space segment resource (which is represented in our case by the satellite transponder). Neglecting CDMA (Code Division Multiple Access), which is suitable only in case of low rate information channels, two other different approaches can be considered for CAMCE satellite network : FDMA (Frequency Division Multiple Access) and TDMA (Time Division Multiple Access).

The FDMA technique consists basically in the division of the available bandwidth (36 MHz in our case) in several fields, each dedicated to a particular active channel. The frequency allocation is obtained assigning to each channel a different RF carrier. With the TDMA technique, on the other hand, the time structure of the transmitted bit stream is organized on frame basis, so as to allocate different time intervals, each dedicated to a particular channel.

For the present application, taking into account that the 2048 Kbit/s channels will be required only during video service operation (TV signal transmission from the CDC towards the CPC), an access scheme based on the FDMA technique seems to be the most suitable solution. Indeed, together with a reduction of the earth terminal complexity, it allows a more flexible service allocation, depending on the evolution of the service demand during the CAMCE system operation.

This scheme, furthermore, is particularly helpful to allocate, together with the 2048 Kbit/s channels, a certain amount of 64 Kbit/s channels, providing the links among authoring centres in case of lack of terrestrial ISDN connections.

Key aspects of interconnection between the satellite network and terrestrial ISDN

This section focuses on the problems generated by the present status of ISDN development, causing poor connection capability for the population of potential customers, which is expected to improve only slightly in the next ten years.

At present, the PTTs of the participating European countries are in the initial development phase of their own public ISDN. According to the Memorandum of Understanding (MoU) agreed upon by the European Administrations, a minimum of ISDN services should be available all over Europe by 1992-1993.

However it is to be noted that the projections of ISDN penetration in the European region foresee that only a small percentage of users (from 5 per cent to 15 per cent) will be supplied by ISDN services in the middle of the nineties. Furthermore user penetration growth is expected to be linear. From the foregoing it is highly likely that until the first decade of the 21st century a large portion of

users will not have the possibility to be linked to the European public ISDN. In this interim period satellite can play a basic role for the promotion of ISDN services.

In the next subsection four scenarios are presented and analyzed. Each one is an example of possible connection problems between users which may arise in the development period of ISDN in Europe, i.e. when some users, connected to the ISDN, need to communicate, in a full ISDN language, with other isolated users (or vice versa).

These examples give an opportunity to show the potentiality of satellite networks to extend ISDN services beyond the borders drawn by the actual growth of terrestrial ISDN.

During the interim period of ISDN penetration, network planners will have to face the troublesome problem of dimensioning the connections between the growing national ISDNs. Such a problem arises owing to the obvious lack of precise forecasts of traffic requirements between users and/or potential users of the new services.

A typical scenario (Scenario 1), which is likely under this conditions, is depicted in Fig 15, where a few national ISDNs, interconnected by under-dimensioned (in term of capacity) links, are shown.

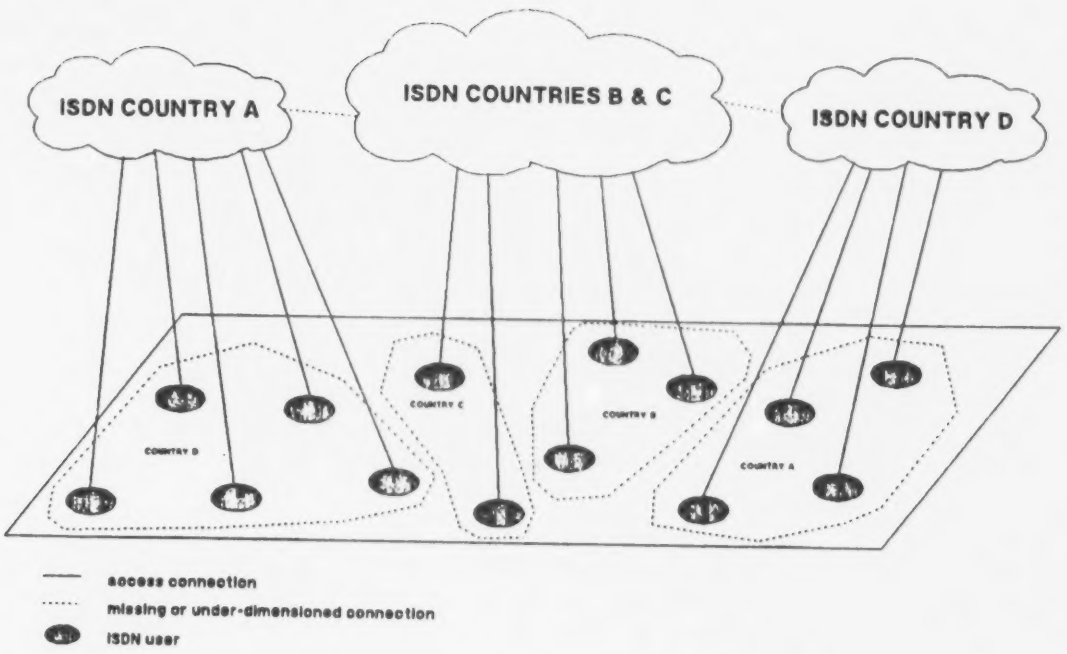

Figure 15

In this context the ideal solution for the interconnection of the mutually isolated networks would be a flexible network, capable of adapting itself to evolving traffic requirements without or with little additional cost. An ISDN compatible satellite network, overlapping and integrating the traditional terrestrial ISDN, fulfils exactly these requirements (see Figure 16).

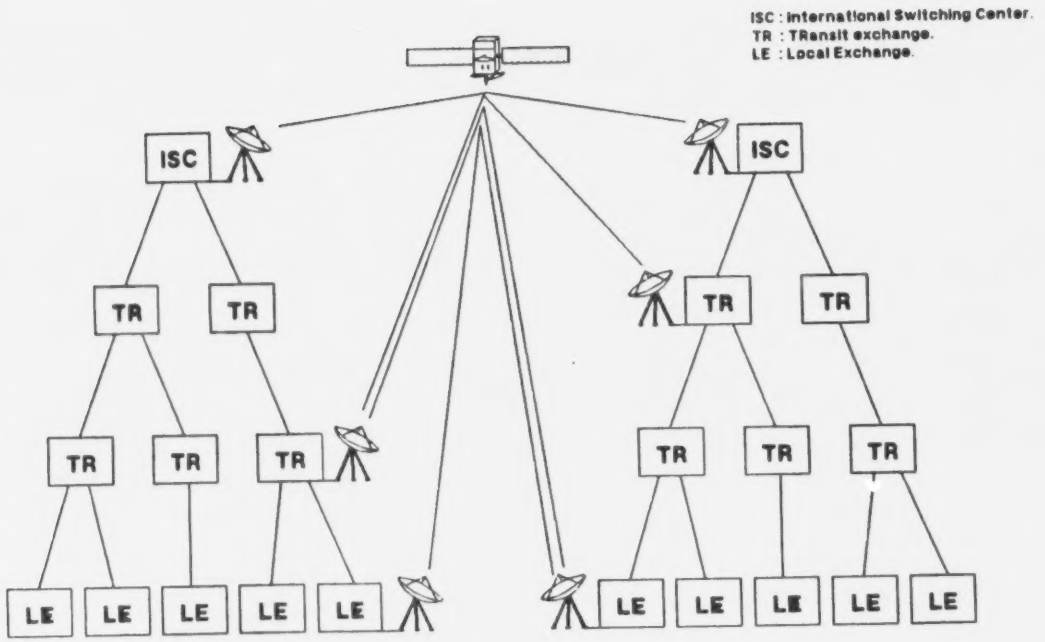

Figure 16

The most common situation, which is likely to be encountered in the interim period of diffusion of the ISDN services, is shown in Figure 17 (Scenario 2), where a certain number of potential ISDN users are not connected to the network (isolated).

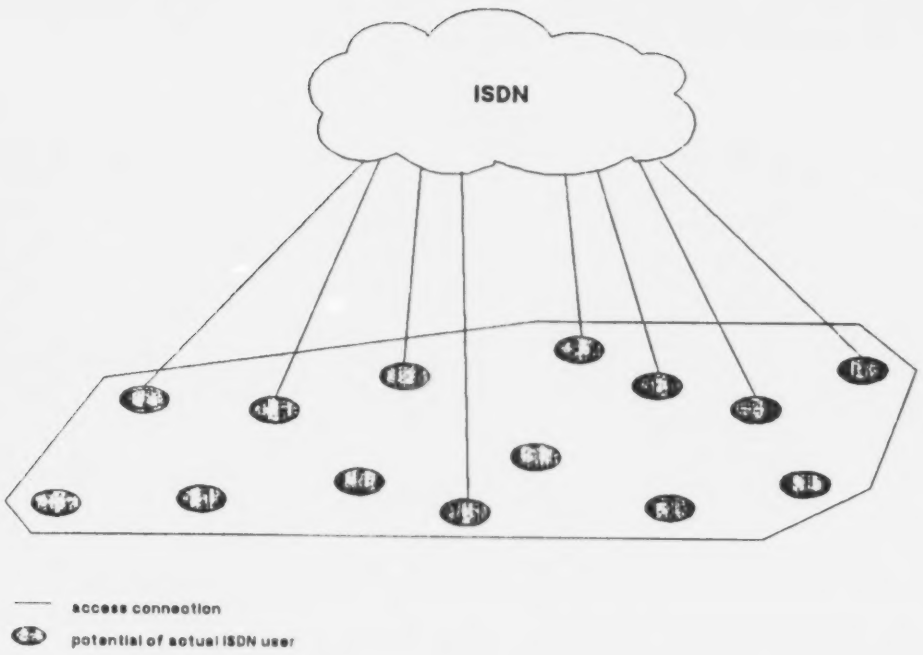

Figure 17

A few solution can be envisaged so as to provide the access to the ISDN for these customers.

In Fig 18 first alternative (Solution A) is presented where a satellite link is foreseen between the Network Termination (the set of devices at the network side of the user-network interface) and the Local Exchange (i.e. the switching equipment connected directly to the users). This represents a very simple and cheap solution to connect isolated ISDN users.

S/T : Reference point located at the user/network interface.
TE : Terminal Equipment.
LE : Local Exchange.
NT : Network Termination.

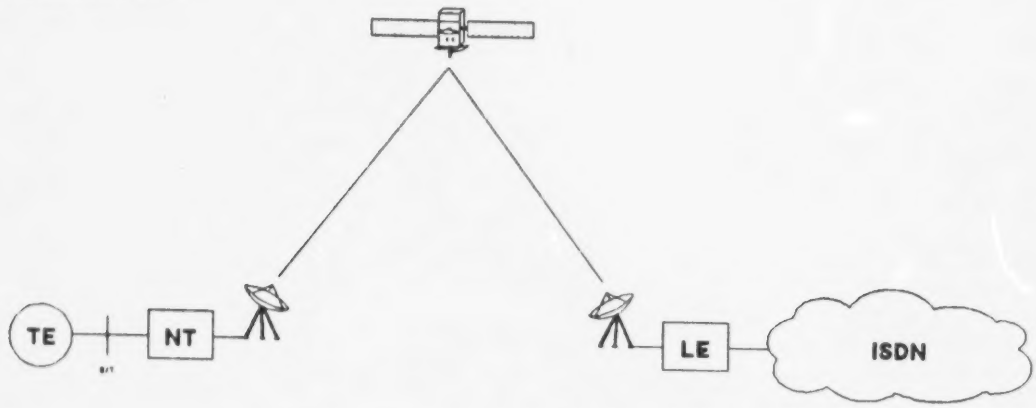

Figure 18

Problems arises when considering the signalling protocols operating between the Terminal Equipment (the set of devices at the user side of the user-network interface which offer ISDN services, such as telephony, facsimile, supplementary services etc., to the user) and the Local Exchange : the Digital Subscriber signalling System number 1.

These protocols are standardized in the CCITT Recommendations I.430-I.431 as to Layer 1 (i.e. physical) of OSI Reference System, Q.920-Q.921 concerning to Layer 2 (data link) and

Q.930-Q.931 with reference to Layer 3 (network). However layer 1 and 2 present some incompatibilities in case of operation over a satellite link (i.e. values of some time-outs, recommended default values of some protocol parameters such as k, the retransmission window, etc.). Anyhow international satellite operators are pressing in order to properly amends such Recommendations.

The above mentioned incompatibility problems can be solved in two ways.

According to Solution B (see Figure 19) a protocol converter can be placed at both sides of the satellite link, i.e. between the Terminal Equipment and the Local Exchange. This device should convert the protocols I.430-I.431 (Layer 1) and Q.920-Q.921 (Layer 2), which are not optimized or compatible to operate over a satellite link, in peer layer protocols tuned for long delays connections.

S/T : Reference point located at the user/network interface.
TE : Terminal Equipment.
LE : Local Exchange.
NT : Network Termination.
PC : Protocol Converter, layers 1 and 2.

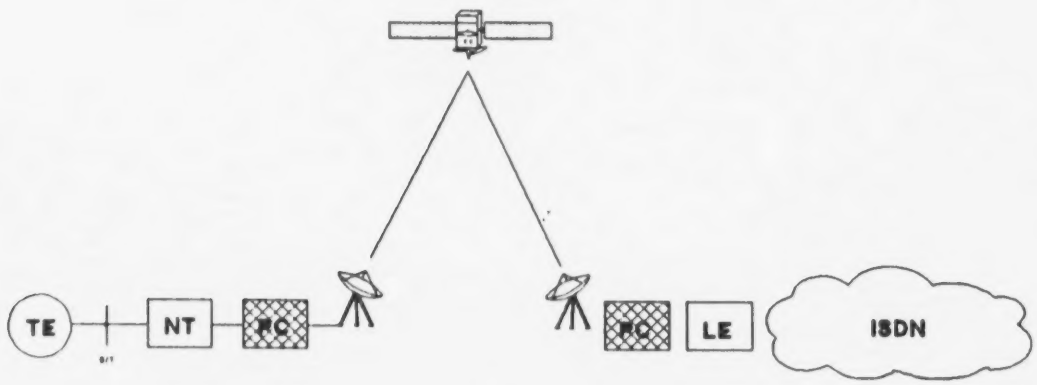

Figure 19

Solution C (see Fig.20) similarly consists of placing the Local Exchange (or at least some of its essential functions) at the user side of the satellite connection, thus sending the signalling data via the (Common Channel) Signalling System number 7 protocols, which are standardized in the Q.700 series CCITT Recommendations and are explicitly designed to work also over a satellite link.

S/T : Reference point located at the user/network interface.
TE : Terminal Equipment.
LE : Local Exchange.
NT : Network Termination.
TR : TRansit exchange.
TR/LE : The corresponding block could be a TR or a LE.
"LE" : The corresponding block should perform only the essential functions of a LE.

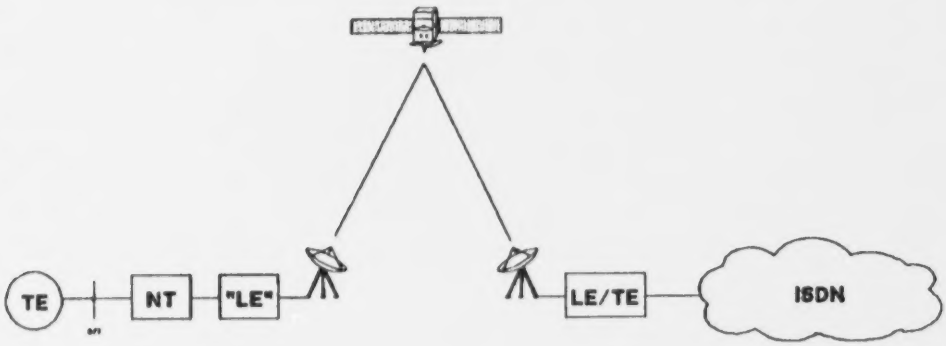

Figure 20

This last alternative is more expensive than the second one since the functions of a Local Exchange are far more complex than those one of a simple peer layers converter for layers 1 and 2. As far as the commercial availability of these devices (i.e. those relevant to Solution B and C) is concerned, it is worth noting that the market is at last becoming sensitive to this kind of equipment, especially in the USA.

The three solutions (A, B and C) proposed in this subsection could cause a double hop end-to-end delay for connections between two isolated users. As a matter of fact, if the data path switching function are performed at the terrestrial exchanges, the path between two users accessing the ISDN through satellite links necessarily experiences a double hop.

However if the two isolated customers are in the same spot, or if the satellite has the capability of switching between different spots, it is possible to connect directly, i.e. through a single satellite hop, the two concerned Terminal Equipment. Figures 6.7 and 6.8 show the two above considered possible system architectures for direct connection of two isolated ISDN terminals.

It is worth noting that while in the single-spot case (Fig 21) no special features are required by satellite payload (this is the case, for example, of isolated user access implemented with a SCPC ISDN-quality-compatible satellite communication system, e.g. IDR), in a multi-spot configuration (Fig 22) an On Board Switching capability is necessary (which will be available only in future generation satellite systems).

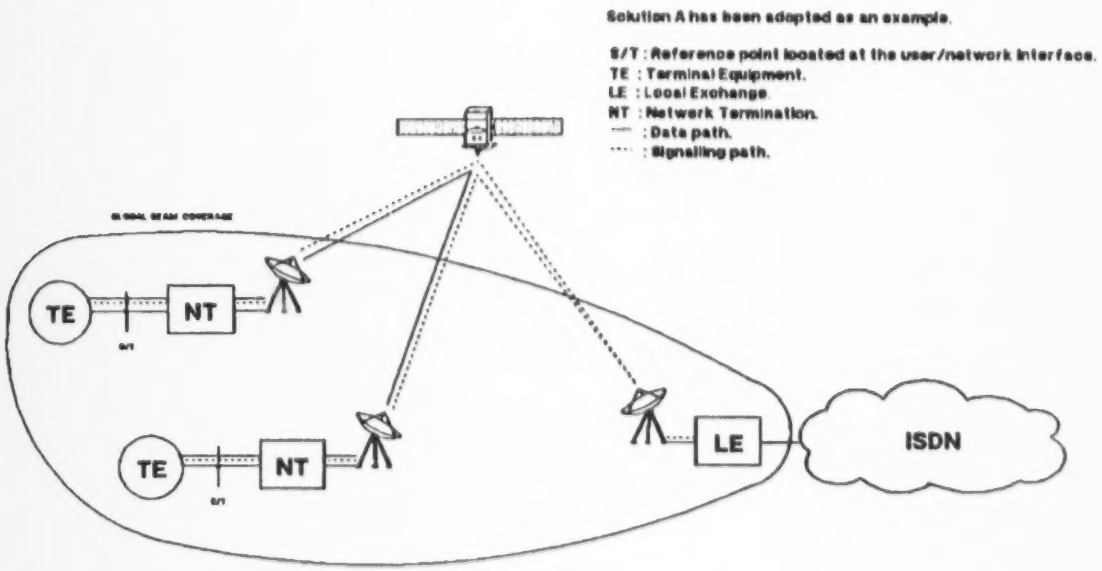

Figure 21

Solution A has been adopted as an example.

S/T : Reference point located at the user/network interface.
TE : Terminal Equipment.
LE : Local Exchange.
NT : Network Termination.
— : Data path.
··· : Signalling path.
— : Satellite control link.

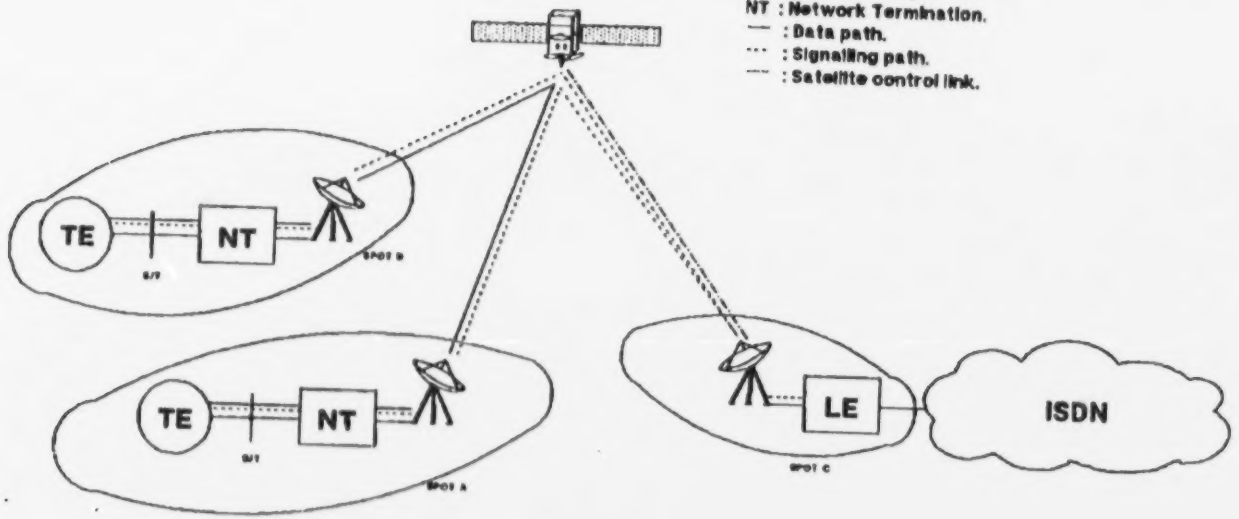

Figure 22

Another common situation which is likely to be encountered in the development period of ISDN is depicted in Fig 23. The relevant scenario (Scenario 3) foresee a few areas or regions entirely isolated from the ISDN world.

The essential difference of this scenario with the preceding one concerns the number of interested users.

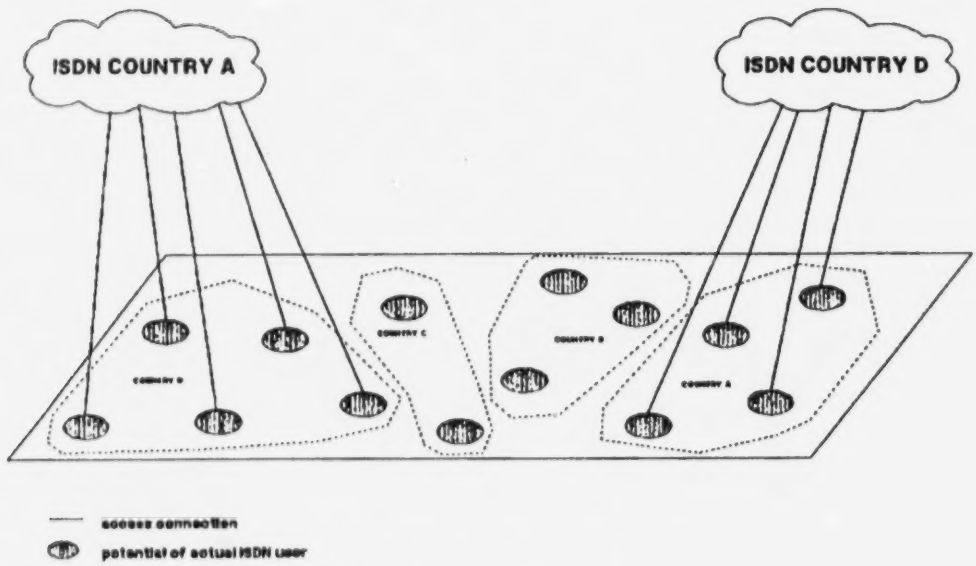

Figure 23

For this scenario two solutions can be envisaged.

The first one (Solution A), shown in Fig 24, is the same as figures 21 and 22.

Reference is made to the previous subsection for details.

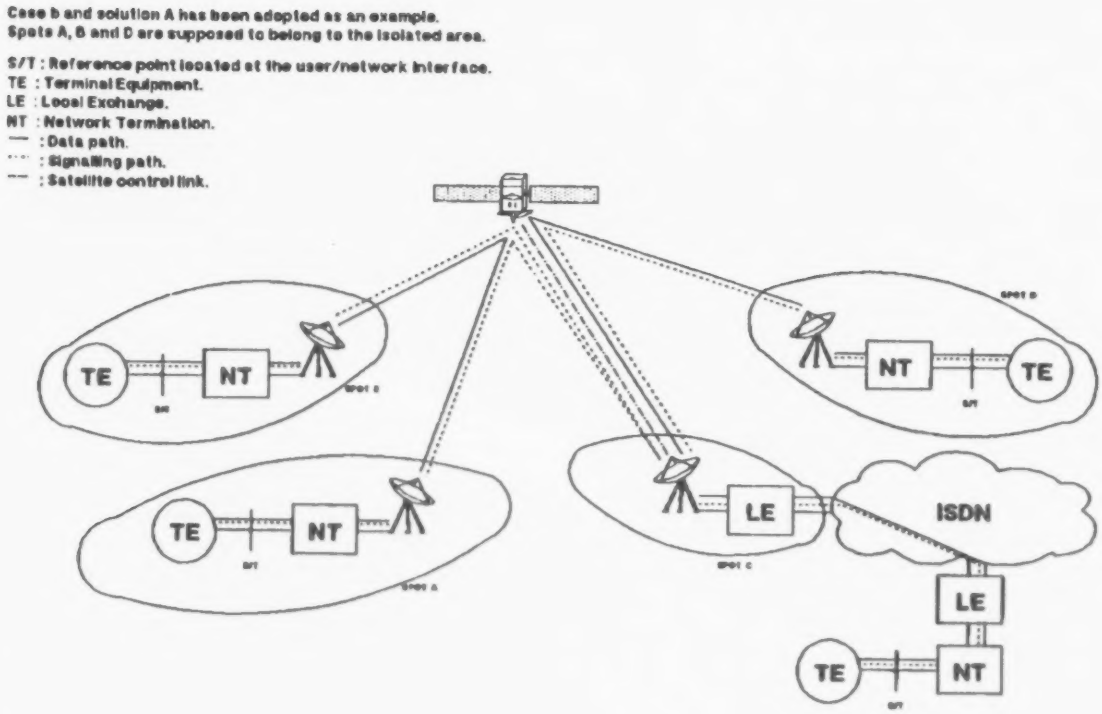

Figure 24

Advantage of this solution is its complete compatibility with the public terrestrial ISDN. Unfortunately for multi spot satellite only future generation systems present the required technical features for optimal operation.

A second solution is possible (Solution B), see Fig 25.

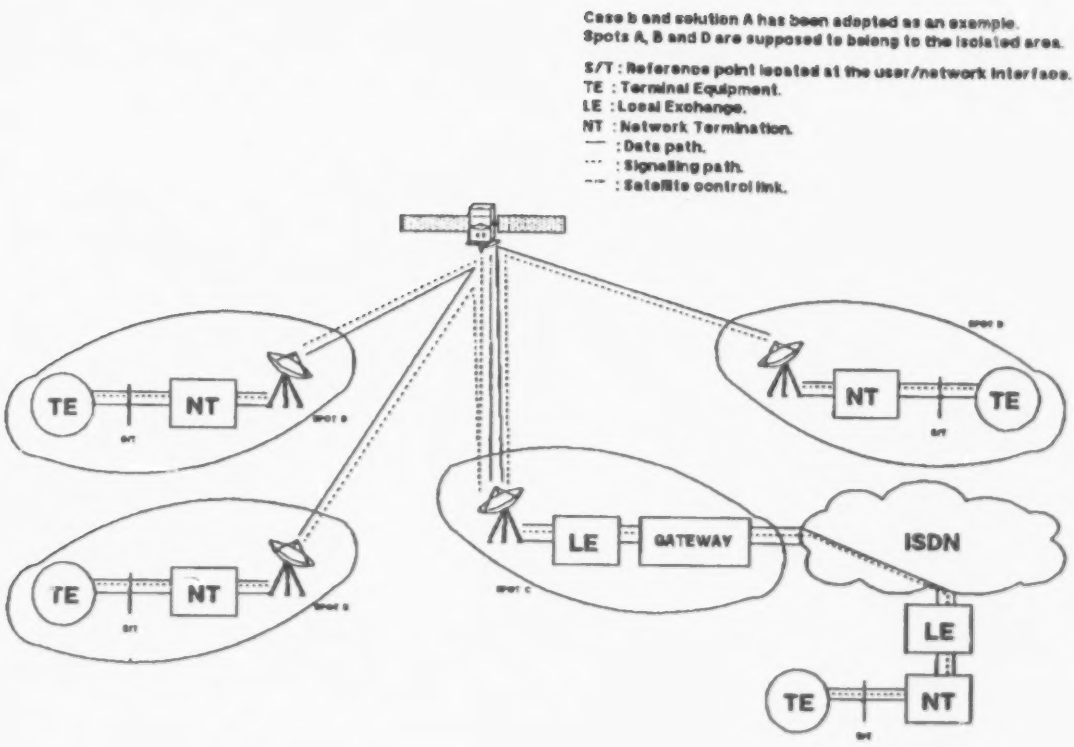

Figure 25

According to this figure all the customers belonging to the isolated region are interconnected by means of an private ISDN, which access to the public ISDN via a gateway, operating according to the interworking standards.

Advantages of this solution are the following :

- Since the Terminal Equipment of the private ISDN do not directly interface with the public network, the ISDN standardized communication protocol can be slightly adapted in order to operate correctly over a satellite link.
- This architecture allows also a certain degree of privacy.

Disadvantages of this solution in comparison with the first one are :

- The lesser flexibility (the communication protocols are slightly different from the standard ones).
- The higher costs for the customer.

The Need for Large Scale Experiments in Flexible Learning

Pierre Landry, Bull S.A.

The Objectives of Large Scale Experiments

The Strategic Review of Flexible Learning completed in February of 1990 recognised the need for large scale experiments in flexible learning. You might ask: why are large scale experiments necessary? The answer is quite simple. Small scale experiments are always successful! Although they are successful, small scale experiments do not wholly demonstrate one of the key gains to be expected from the use of satellite and cable dissemination - that is the realisation of lower unit costs in learning through the creation of a large constituency of learners at any one learning event.

Another problems with recent experiments is that they are not always followed by dissemination. They seem to generate insufficient momentum to carry a new technique over into regular practice.

> *What would be the specific objectives of large scale experiments? What priorities should be set for them?*

Would it be to test new learning services? To test their impact on the end users? Or would it be to test the potential markets for authoring and production tools? New learning products? Or training services? It should of course be all of these. But a crucial factor sometimes overlooked is that in turning to technology based solutions to training problems we must look again at the complete chain which goes to make up any particular training paradigm.

The Learning Paradigm

To do this I would like to draw your attention to an article published in Educational Technology and written by Robert Brown.

Brown points out that in the traditional oral training paradigm the teacher was the focus of learning. The teacher encompassed both knowledge and experience and through oral presentations to students this limited knowledge-base was transmitted.

Gradually the knowledge-base was expanded through the introduction of written material. Still the instruction was presented to the student in a one-way delivery. Later students recited orally or did written work to be evaluated by the teacher.

In contemporary instruction the teacher is still the principal source of knowledge and experience and serves as a deliverer of information as well as a gatekeeper and controller of the knowledge base. However the number of genuine interactions has increased with the introduction of better teaching materials such as textbooks, workbooks and audio-visual aids.

At the same time informal interaction between students has also increased.

This model has underpined learning now for some sixty years. With the massive increase in the knowledge base of recent decades and the requirement for continual updating of skills, the "flexibility" to make a significant contribution to the modern economy requires new thinking, a new model for learning.

I follow Robert Brown in his assessment of what is needed - a system in which each student interacts with the teacher, but also interacts with a database facility and with an intelligent tutor and formally with other students. This gives the student four points of reference - to the teacher, to databases, to an intelligent tutoring and monitoring system and other students. These reference points should be seen as optional as well as complementary and very much under the control of the learner. The future paradigm is after all one which is learner centred and performance-paced. It is a paradigm which takes the best advantage of the technologies on offer.

In a learner-based model, the learner needs to be supported by learning materials, by support personnel, and by the careful organisation of the learning process.

Producing a New Training Service for the New Paradigm

There are several essential steps towards this new paradigm. It is of course essential to develop the information and telecommunications technologies and to test their conformance to standards, quite apart from testing their suitability to the learning domain. It is necessary to develop the tools to facilitate distance collaborative authoring and distance learning - this is very much the area

in which DELTA has sought to make its contribution. Then there is the job of developing learning products which are suitable to use in a new learning environment - something which the University-Enterprise partnerships sponsored by COMETT has been concerned with.

Then there is the actual provision of the service, the packaging of the software and its delivery to students, and the consequent monitoring and assessment of work. Several European organisations are now concerned with developing these services for the new learning paradigm, amongst them EUROSTEP, EUROPACE and EUROTECNET. (Fig 26).

development. These expectations have to be established in the culture and routine of an organisation. And they have to be monitored in order that they can be improved.

Second, there has to be a policy which addresses the individual's capacity to cope with new training methods. This is very much a matter of staff selection procedures. The employee selection procedure has to be improved such that it provides the organisation with staff who can adapt to new learning methods.

Given a sufficient level of skill, there has to be a mechanism to orient and train people, a mechanism which is also open to improvement.

THE COMPLETE CHAIN TO PRODUCE TRAINING SERVICES

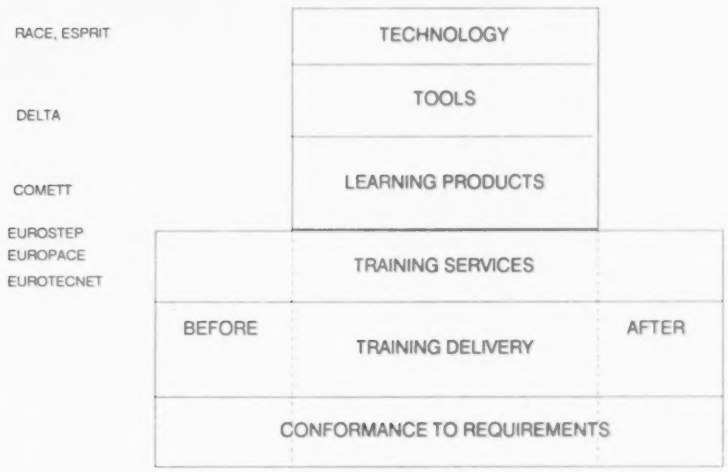

Figure 26

The creation of a new service entails these steps but of course requires much more than this. When it comes to the Company or organisation, it involves us in a re-assessment of the culture surrounding training, especially training at work. This in turn, I would suggest, obliges us, as companies, to address a whole range of factors which I will now attempt to summarise.

There are a number of factors affecting the performance of the learner, at work, which have to be predesigned. These have to be provided for in clear unambiguous policies and functions. And they have to be incorporated into any organisations system for developing and improving performance.

First of all there has to be a clear set of expectations about what is required of the individual employee in terms of his/her training and resource

Skills and knowledge are not adequate in themselves to ensure that good human resource development contributes to organisational objectives. Jobs have to be designed in such a way that new learning procedures can make the appropriate contribution. This means that companies must have an eye on the improvement of the design of Jobs and tasks, taking into account changing skill requirements.

Training has also to be motivated. Staff can easily be demotivated by the wrong systems. To ensure the success of continual training as a philosophy it is important to create motivational systems which themselves are open to improvement.

PERFORMANCE FACTORS	PERFORMANCE SYSTEM FUNCTIONS	PERFORMANCE IMPROVEMENT CONSULTING
Expectations	Establish expectations	Clarify expectations
Capacity	Select people	Improve employee selection process
Knowledge & skills	Orient & train	Improve orientation & training
Job/task design	Design jobs & tasks	Improve design of jobs & tasks
Incentives	Motivate or de-motivate	Improve motivation systems
Feedback	Provide feedback	Improve feedback systems
Tools & resources	Provide tools & resources	Provide tools & resources

Figure 28

This whole process, you will gather from what I have already said, is not a static one. The organisation itself has to learn from the systems it is developing. There must be feedback systems which allow experience to be fed into the process of clarifying expectations, employee selection, orientation and training, job design, and motivation.

Finally it is important that the system is supported by the right tools and appropriate levels of resources.

These features represent, when implemented, a significant change in the way staff might be trained. In any commercial or industrial organisation change of this magnitude needs to be properly managed. That in itself requires a systematic identification of the changes which are needed. It requires an assessment of training needs, the development of a training plan, the organisation of training delivery so that it is reliable. It must, demonstrably, contribute to performance enhancement. This implies quantifiable results and that in turn implies a rigourous evaluation of training delivery, and performance enhancement.

Equally of course it is important to apply the quality approach to the evaluation of new training services. By saying this I wish to draw attention to the increasing importance attached, in industry, to the management of quality throughout an organisation. Industry is at present reflecting on quality management at all levels of an organisation, and these principles will also need to be applied to training.

THE COMPLETE CHAIN TO MANAGE THE CHANGE

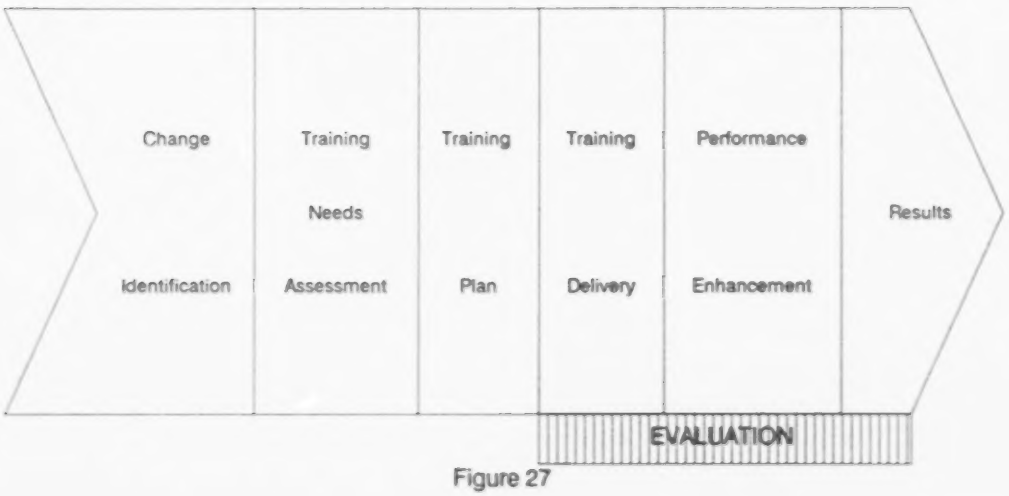

Figure 27

Evaluating New Training Systems

What kind of evaluation is most appropriate? Is it an evaluation of new skills acquired? Of the performance improvements in specific tasks? Or is it an evaluation of the impact of new training services on a company's business?

I would propose that, from the individual's point of view, the measurement process should have five stages.

The questions asked of the system should be:

1. To the individual employee-employee - what did you learn?

2. Also to the individual employee - how valuable did you find this training?

3. The company should also ask will trainees use the new knowledge or skills on the job?

4. From the point of view of the business' performance the question has to be asked - was the training or development actually worth it? Has it enhanced business performance.

5. And the acid test of this, is the final question - should we do it again?

In effect the most important questions for companies are:

How to train staff:

- Better
- Faster
- Cheaper

Many companies are beginning to ask, are technology based training services an element of the solution? In order for us to make an informed judgement of this, we require the experience and the evaluation of large scale experiments, experiments which are on a sufficient scale to allow us to make an informed judgement of their value to our business performance.

We should bear in mind, also, that large organisations are in a period of profound change. This is in part a result of the demographic crisis which has frequently been quoted as the major problem of the future supply of human resources. In considering new training services for the future, we have to bear in mind that training is only one solution to the problem of managing change. Organisations have a range of priorities. Training has to make its case in competition with other demands on the attention of industrialists. That I would argue is another reason why the training community now needs to come forward with demonstrable results from large scale experiments.

Remote Training Services: a medium-term view

Richard Walker, EPOS

Introduction

There is tendency to assume, amongst members of the Technology Based Training Community (TBT), that rapid growth in remote training is in some way inevitable. This is not so - if it were, programmes such as DELTA would not be necessary. What I want to do in this paper is to argue that rapid growth in the TBT market is indeed possible but only on certain conditions. In order to understand these conditions it is necessary to understand the reasons which make a low growth scenario a credible one.

The Need for Remote Training

One of the strongest arguments in favour of the DELTA programme is the obvious usefulness of effective remote training. The case for remote learning has been repeated so often as to become something of a commonplace; it is nonetheless a valid one. Rapid technological and organizational change within the West (and East) European economies has radically changed industry's training requirements. Maintaining a competitive edge requires the continuous retraining of staff at all levels from top management down to manual, clerical and sales staff. With conventional classroom training such "continuing education" is an economic and organizational impossibility. It follows that effective remote training is not a luxury - a new way of teaching esoteric subjects to retired school teachers - but a critical success factor for the competitiveness of the European economy.

Technology

The need for remote training undoubtedly exists. It should be added that the technology to fulfil that need also exists. The European Open Universities show the effectiveness of traditional technologies such as radio and television; programs such as EuroPACE show how these can be extended by the use of satellites; last but not least there is a growing number of "TBT mature" companies (I could cite the examples of SIP, Deutsche Bundespost, Digital, IBM) who are successfully using computers in the training of their staff and/or customers.

Over the next five years there can be little doubt that learning technology will improve - even without DELTA. The almost vertical drop in the cost of processing power, RAM and mass-storage, the availability of increased capacity in telecommunications, the rapid spread of graphical user interfaces, the increasing use of object-oriented programming techniques, the emergence of multimedia standards all militate in favour of more effective use of computers for learning.

Current trends

I have just argued that the need for remote training exists; that we have the technology to fulfil this need and that this technology is going to rapidly improve over the next five years. How do you reconcile this with my low-growth scenario?

Let us assume for a moment that the future can be predicted on the basis of current trends. What are the key trends on the TBT market today? If we want to look at this market we have to distinguish between different technologies. At one extreme we have interactive video (as witnessed by some excellent products shown in the recent ETTE exhibition in the Hague) where the computer acts essentially as a display and switching device. The high costs of quality products (actors, filming etc.) make this into something of a niche technology. At the other extreme we have sophisticated simulation software used in the training of specialised staff such as pilots, operators in nuclear reactors or in chemical plants. This software provides a very convincing demonstration of the power of computers in training. Again however high costs make it a niche product. While interactive video and sophisticated simulation can provide a good living for small specialist companies they are unlikely to make more than a marginal contribution to the massive introduction of remote training which the European economy seems to need. What is needed are middle of the road products which can cater to the needs of large numbers of users at a cost which managers believe they can afford. At the moment the growth trend for this kind of product is extremely slow. It is useful to try and see why.

If a training manager wants to invest in TBT he has three options open to him: he can buy a ready-made product; he can use his own staff to write courseware; or he can commission it from a specialized company. In all three cases he is faced with the same basic problem, namely quality. Ready made courseware is unlikely to fit his needs; in-house work is expensive and rarely reaches professional standards; specialized companies with a good track record (and with the

ability to work in different European languages) are hard to find. Faced with the certainty of heavy costs and great uncertainty as to the final results, the majority of training managers decide to wait "until the technology is more mature".

To sum up the need for remote training exists; the technology also exists. What does not exist as yet is a reliable and affordable way for the training manager to apply the technology to his needs. So long as this remains the case investment in TBT will rely on the "entrepreneurial" spirit of decision-makers - a spirit more often to be found in economics textbooks than in large corporations.

A Vicious Circle and How to Break Out of It

Managers refuse to "gamble" on TBT; demand is consequently low; producers fail to improve the quality of their product and guarantee their survival with high prices which further discourage investment. If we are to break out of this vicious circle - thereby avoiding the low-growth scenario I presented at the beginning of this paper - we have to change the attitudes of decision-makers. The real question is how?

Probably the first thing we have to realize is that technology on its own is not enough. Training managers are not interested in the intrinsic beauty of authoring systems or intelligent tutoring systems or user models. Quite often they have a distrust of computers only matched by their dislike for computer salesmen. The training managers' job is to train people, as cheaply and effectively as possible; technology is a tool to this end, and nothing more.

If training managers are to be convinced of the virtues of TBT the essential thing is to show that it works. In other words escape form the vicious circle requires success stories. Major organizations with large numbers of users have to apply TBT, prove that it works and then publicize the fact. For the reasons already stated this is unlikely to be a spontaneous process. It is here, if we are lucky, that the European Community comes in.

DELTA

The current phase of DELTA has largely been concerned with technology as an end in itself. I have no figures for the number of learners currently using technology developed within the DELTA program but I expect it is very low indeed. As a DELTA document puts it somewhat euphemistically.

> *"As yet there have been no experiments on a sufficiently large scale to integrate the technologies and to field-test the users reaction to integrated systems"*

The latest documents produced by DELTA show a very clear intention to correct the mistakes of the past. The new, practical emphasis of the program is particularly evident in the tasks listed under series 300. As stated by the document quoted earlier

> *"...To validate the users reaction to learning technology and to ease the uptake by the market large scale pilot testing experiments need to be carried out on a European scale...".*

If the basic argument of this paper is correct this kind of pilot testing is a necessary, indeed an essential, condition for the rapid expansion of the European TBT market and thus for avoiding the pessimistic low-growth scenario I proposed at the beginning. In other words the DELTA successor program could provide the impetus for the take-off of TBT.

It could but this is by no means inevitable. We have to remember that the key question is convincing decision-makers. In other words DELTA programs have to be appealing to managers. This has a large number of implications of which I would suggest just a few:

DELTA has to be attentive to what training managers want as well as to the technologists want to give them. I hope I offend no-one if I say that this might well mean giving more attention to resolving practical questions concerning the way technology is applied (the proposed Common Training Architecture is a move in this direction) and less to more esoteric questions. It may also imply a reduced emphasis on formal methodologies. Given that two thousand years of western culture has yet to produce a formalized methodology for teaching by a human being there is no reason to expect that there we can achieve such a methodology for teaching by machine.

- It should be clear that the aim of pilot programs is not to validate a particular technology but to develop credible remote training services. We must therefore avoid the "not invented here" syndrome. Pilot projects should be aware of useful commercial technologies and exploit these to the maximum. This is particularly important in fields such as graphics user interfaces, multimedia standards and telecommunications.

- Pilot projects have to large in order to be credible. It is very important that they should involve industrial as well as university environments.
- Funding for research projects has to be realistic. There is a critical mass below which projects are unlikely to achieve measurable results.
- Last but definitely not least management of research projects has to be organized rationally. It has to be recognized that certain key research tasks (such as software or courseware development) have to performed by people working in day to day contact on the same site. No amount of E-mail can substitute elbow to elbow contact.

If DELTA works in this direction then I believe there is a real chance that it could make a genuine contribution to getting TBT off the ground, and this in its turn could be a real bonus for the European economy.

If on the other hand DELTA fails to live up to its promises then the development of TBT will have to depend on market forces - just as it has been for the last twenty years. If this should happen then the scenario I presented at the beginning is indeed a very realistic one.

Evaluation and Assessment Strategies for Pilot Experiments

Chris Curran, Ann Wickham, National Distance Education College, Ireland

Introduction: Evaluation and Assessment in Distance and Open Learning

Evaluation and assessment are essential components of distance and open learning. Evaluation contributes to the development and teaching of programmes; assessment is widely used to examine the extent to which the results of programmes and pilot projects accord with their objectives.

While the context of evaluation and assessment can vary quite widely - from the assessment of a single student to the evaluation of whole systems - common applications in the Irish National Distance Education Centre include :

- the evaluation of pilot courses;
- the monitoring of tutor performance;
- the assessment of learner support systems; or the
- cost assessment of alternative approaches to course development and teaching.

In general the objectives of evaluation and assessment are to ensure that the quality of the various processes involved in distance and open learning are of the required standard, and to secure the best return - in educational and economic terms - for the available resources. The stage at which evaluation and assessment is undertaken depends on whether the approach is formative or summative. Formative analysis is most evident where the results of the evaluation can influence the process of development; for example, in testing out alternative teaching media in a pilot programme. Summative development is more common where the aim is to establish whether the objectives of the programme have been successfully achieved. Thorpe (1988) provides a useful survey of the field.

Evaluation and Assessment of European Pilot Projects

It must be said, however, that in spite of their central role in distance and open learning, the formulation of strategies for the evaluation and assessment of advanced learning technologies, on a European scale, raises issues of a different order. The development and application of a telematic network enables communication technologies and new information technologies to be combined to expand and improve distance and open learning. However, this new and original combination also brings its own problems. We can get some feel for the magnitude of the issues involved by contrasting the context with, let us say, the common experience of the monitoring of tutor performance on a nationality based distance taught degree course.

Transnational Evaluation and Assessment.

The first differences arise from the multinational character of Community-wide projects. Transnational co-operation in the development and teaching of distance education programmes - while growing, is still at an early stage of development; as a consequence the evaluation and assessment of distance education programmes is largely restricted to a local, regional or national context.

Community experimental projects, by contrast, embrace twelve member states, with all the attendant problems of trans-national evaluation and assessment. The potential problems of culture and language are too well known to need emphasis; the marked differences in educational philosophies and training needs are less obvious, but no less significant. Given the wide disparities, which are known to exist, between the industrial structures and skills profile of the various regions of the Community, the difficulties of assessing the pedagogic effectiveness of a particular mode of teaching, for example, on a common comparative basis, should not be underestimated.

Scope

The scope of the programme which is to be evaluated, is also very different. At an operational level, instead of a single university, there will be groups of partners - drawn from education, industry and other sectors, with all the attendant difficulties of communication and co-ordination which this entails.

The differences in scope are more significant still at the stage of implementing the results of pilot projects, for example, in using them to forecast the potential application of alternative approaches to the delivery of distance and open learning. A telematic network covering the twelve

member states (with potential for still wider application), poses difficult problems of comparability, for example with regard to imbalances between member states in their technological infrastructures (to support the application of advanced learning technologies), and in ensuring equity in student access to essential reception equipment. However efficient a particular network may prove in pilot experiments, the results cannot be extrapolated with confidence on a Community-wide basis, where the imbalance in access to electronic networks is so much more uneven than is the case within national programmes.

Focus of Experimental Projects.

There are differences also with regard to the focus of experimental projects, and in particular with regard to the clarity of objectives, between those of a single distance teaching university and community-wide programmes. The focus of programmes at a Community level are often more diffuse - hardly surprising perhaps in view of the wide, and often conflicting, interests and expectations which must be drawn on in support of programmes. This diffuseness is a major obstacle to the development of effective evaluation and assessment.

Evaluation and Assessment of Advanced Learning Technologies

The evaluation and assessment of programmes involving the application of advanced learning technologies, is subject to special difficulties. The range of technologies is wide, with marked differences between them in their economic and pedagogic characteristics; and in the manner and scale of their application.

Theoretical Base

Moreover - while there are differences between evaluation and more fundamental forms of social research, in the focus on applications for example - because of the nature of distance and open learning, and of the problems encountered in the application of the new technologies in this field, the theoretical basis for evaluation and assessment may draw on a range of disciplines. A limited comparative analysis of alternative instructional media - interactive videodisc vis-a-vis conventional CAL for example - may draw on theories from the fields of educational psychology, semiology, economics, and computer science. Larger studies of advanced learning technologies, of the kind supported by Community programmes, may draw on a still wider range of disciplines.

Focus of Evaluation

The increasing sophistication of technology applications in distance and open learning programmes will inevitably make evaluation and assessment more complex. The highly structured approaches of early CAL (computer assisted learning) programmes were easier to evaluate than some contemporary programmes which afford students a higher degree of flexibility in their approach to learning - hypermedia, for example, which allows students to make their own links, add comments and suggest developments (Megarry 1989). Berg (1990) has described the use of CAL in combination with an electronic laboratory in the teaching of computer science in which "... students can widely influence presentation parameters in time and space".

Similarly in the case of computer conferencing, for example, in addition to the normal evaluation of the students use of course materials and formal contacts with tutors, it is necessary to examine the complementary, and often spontaneous, links that develop between groups of students (Mason 1990; Soby 1990). The patterns of learning which emerge are often articulated in ways that cannot be predetermined, yet need to be evaluated in the context of the course as a whole.

Generic Evaluation

As a consequence of these differences, vis-a-vis more traditional forms of distance and open learning, the evaluation and assessment of advanced learning technology applications is often fragmentary, and comparability of results between programmes is rare. The evaluation and assessment of advanced learning technologies in distance and open learning is a relatively undeveloped and disparate field. Many of the evaluations that have been undertaken relate to specific projects, in a single institution. The variety of contexts and differences in the aims and methodologies of evaluation are such that these studies may share little in common other than the technology itself.

This is a significant deficiency. Evaluation and assessment which focuses solely on the success or failure of a single programme, and fails to address the underlying concepts or approaches, adds little to our understanding of the generic issues involved in the application of new technologies in distance and open learning.

The Need for Evaluation and Assessment.

It is essential to address these generic questions, especially those of pedagogic and cost effectiveness.

Cost Effectiveness

In the case of cost, for example, most studies of the costs of media have been concerned with their use in conventional education. Cost studies on the use of media in distance and open learning are relatively few in number and for the most part relate to well established media, primarily television and radio. Moreover for the most part these studies relate to the use of media in less developed countries, and are focused on macro-economic investment decision, rather than on the use of the new technologies in operational distance teaching programmes.

As a consequence relatively little is known about either the costs or cost-effectiveness of the newer information technology based media. This is an important omission. It hardly needs stressing that no matter how pedagogically effective a particular medium may be, it is unlikely to be extensively used if the cost of developing and delivering courses, through that medium, are substantially higher than those of the established media. Moreover, even should the newer technology based media prove more cost-effective, lack of clarity with regard to the relativity of cost is likely to delay their application in distance and open learning programmes.

Pedagogic Effectiveness

The evaluation of the pedagogic effectiveness in distance teaching programmes is widespread. It is undertaken using quantative or qualitative techniques and at the formative or summative stage of evaluation.

Systematic evaluation and assessment of the more advanced learning technologies has been limited, in part because of their relative newness. Even in the case of Computer Based Learning our understanding has not kept pace with developments (Smith and Keep 1988; Whiting 1986); it has been argued, moreover, that much of the research undertaken in that area so far is of doubtful value in that it addresses irrelevant or unanswerable questions (Soloman and Gardner 1986). Studies of direct relevance to distance and open learning are particularly sparse.

In spite of this relative lack of attention, the new technologies have much to offer distance educators, for example, in their potential for reinforcing student support systems. Non-contiguous tutorial support to students - which traditionally has been provided through correspondence, and to a lesser degree by phone - can, in principle, now be provided through ISDN networks, by computer conferencing (Bang and Moeller 1990; Lorentsen 1989; Mason 1988; Soby 1990), by satellite, or may be built into the teaching software itself. However the effective application of these technologies impose new demands on both staff and students in distance education programmes (Feenberg 1989; Mason 1990), to which evaluation and assessment systems will need to have regard.

Similarly student dropout, always a primary concern of managers of distance education programmes, can take new forms in technology based courses - for example the students in computer-mediated programmes who never log-on (Bang and Moeller 1990; Lorentsen 1989; Mason 1990; Soby 1990). It is essential that these, and related problems, are identified and addressed in the evaluation and assessment of these new programmes.

In too many cases the new technologies have reinforced traditional modes of teaching and have missed the opportunity of giving learners a more active role in learning (cf. Education Technology Centre 1990 : Rowntree 1986). Existing models of teaching and learning may well prove inadequate in this new context (Hodgson 1989), and attention needs to be directed to this issue. Evaluation will need to have regard also to the needs of teachers and trainers in systems based on advanced learning technologies and in particular to pedagogical problems they can face (cf. Brander Christensen 1990, Tucker 1989).

Strategies for Evaluation and Assessment.

The formulation of strategies for the evaluation and assessment of experimental projects, in relation to the development of a telematic network for distance education and training in Europe, is a complex issue. What follows therefore is very much a personal view of some selected issues which, it seems to us, need to be addressed in the formulation of strategies.

Definition of Goals.

We need to start by defining our goals as precisely as possible in terms that are unambiguous, specific and, in so far as possible, measurable.

It is important to stress that evaluation and assessment are merely one element in an experimental project, and that the criteria for effective evaluation and assessment are dependent on the project goals. If the criteria for defining the objectives of experimental projects are unclear, it may prove impossible to devise an effective strategy for evaluation and assessment. Broad, generalized aims, however desirable in terms of securing support for trans-national programmes, give rise to great difficulties in defining, let alone measuring, the output of experimental projects.

As distance educators we need to define with more precision the objectives of experimental projects at a European level. An objective such as "The assessment of the viability of large scale networks in distance and open learning" embraces so many implicit, ambiguous and even contradictory sub-goals, that it is likely to give rise to unreal and very different expectations on the part of distance educators.

The aims of a programme not only have to be specified with precision, they also need to be accompanied by carefully thought out objectives. These objectives need to be listed in order of priority and accompanied by criteria for their review, together with rating procedures.

Is, for instance, cost effectiveness to be the main objective of a distance teaching programme using new technology ? If so what are the criteria to be used in assessing cost effectiveness and how are these to be rated by evaluators? Until aims and objectives are clear and a system of priorities is established it will not be possible to develop effective evaluation and assessment procedures.

Tasks to be Addressed

The selection of tasks to be addressed will inevitably involve making choices between possible goals, perhaps even to the extent of selecting short-term and definable targets, over longer-term and less easily defined possibilities. For example, it is clear that the new technologies offer considerable potential for enhanced communications in distance and open learning; while the possibility of replacing teachers by intelligent and adaptive machine-based tutorial systems is a longer-term - albeit exciting - possibility. Similarly while the development of a Community-wide technological infrastructure, for the delivery of distance and open learning, is an exciting and worthwhile aim, this will take some time to put in place, given the existing marked imbalance in access to network points and workstations. On the other hand there is strong evidence of increasing co-operation between institutions in Member States involved in distance teaching, and the provision of a network to support this co-operation could be achieved at relatively low cost.

At a more general level it is vital that the tasks to be addressed should embrace pedagogical effectiveness, not least from the perspective of the learner; and cost effectiveness, including an assessment of the market potential for the technology based distance education and training.

Pedagogical Effectiveness

It is clear that the application of technology can change the traditional relationships and processes of distance education in unexpected ways, and as a consequence there will be a need to provide for the evaluation and assessment of these changes. The possibilities for learners to take an active role in the creation of their education and its direction and objectives means that evaluation will have to take a complex and sophisticated form. The range of issues needs to be defined, examples of possible issues include:

- the coherence, relevance and accessibility of course materials.
- the effectiveness of learner support systems, including provision for formative self-assessment.
- the pedagogic effectiveness of alternative media and teaching methods.
- provision for adult and other non-conventional students.
- learner performance at course completion and dropout.
- the relevance of existing models of teaching and learning.
- the effects of new communication systems on tutor-student relationships.
- the need for training of tutors and students in the effective use of the new technology-based systems.

Cost Effectiveness

Cost, and more significantly comparative cost, is a critical parameter in the response to the opportunity provided by the new technologies in distance and open learning. There is a well established methodology for the evaluation of cost-effectiveness of media in education, however its application has been limited to a few studies.

The range of available technologies is now wider, and the environments in which they operate, and the student populations served, are more diverse. There is an urgent need for the comparative analysis of costs, for single technologies across a range of systems, and for a range of alternative technologies within a single system.

The demand for technology based systems is still somewhat uncertain. Many writers have commented on the resistance to change which, it is claimed, is characteristic of education systems - albeit, it should be noted, distance educators have proved notable exceptions in this connection. Nevertheless it remains the case that the new technologies in Western Europe have been introduced on a rather piecemeal and ad-hoc basis (Bates 1990), and in general on a minor scale. As Curran has noted "In practice many distance education institutions are locked into existing approaches to the use of media, to a greater or lesser degree. This relatively fixed approach makes anything other than marginal changes in use difficult to achieve." (Curran 1990)

The essential issues which need to be addressed include :

- capital/staff/student ratios in technology based systems.
- the level of direct vis-a-vis hidden costs.
- the potential demand for technology-based programmes.

Unanticipated Outcomes

We need to provide for the identification of unanticipated outcomes of using the new technologies in distance and open learning. For example in an evaluation in our own university, of satellite delivered programmes in combination with national broadcasting to SMEs (small and medium size companies), we found that the problems of low take-up were not, as anticipated, related to the advanced content of the programmes. We found that problems of low take-up were related more to difficulty of promotion of an awareness of the programmes among the managers of SMEs, to the timing of programmes, and to time involved, for senior personnel in SMEs, in scanning video material for content of direct interest. This experience has lead us to adopt a quite different approach to the use of this technology.

Common Measures

We need to address the problem of defining and agreeing on common measures - or indicators of outcomes - which would provide a basis for the comparability of results of studies. This will not be easy, one has only to compare the wide variations in the approach to the measurement of drop-out between distance teaching to realize the difficulties involved.

Approach to Evaluation

We need to consider the most effective approach to evaluation and assessment. There a number of possible approaches. However the issues to be addressed can conveniently be considered by examining two of these :

- (a) common assessment - that is the use of one team to evaluate a range of experimental projects;
- (b) internal assessment - that is the evaluation and assessment of each project separately.

To some extent the choice between these two approaches, or a combination of both, would depend on whether evaluation is formative or summative.

Option (a) - common assessment would have the advantage of providing a basis for the standardization of approach and input/output measures, and should ensure more objective evaluation across a range of projects. This could facilitate comparative analysis of results. However the inclusion of external specialists in the evaluation team could give rise to problems in assembling and maintaining a team of evaluators over a sustained period of time. More important still perhaps, external evaluation might discourage participation in such projects, although this has not proved to be the case in higher education where the use of external examiners is common.

Option (b) - internal assessment would have the advantage of convenience and low cost, but may be somewhat more prone to bias, and presents considerable difficulties in the application of common approaches and in the making of meaningful comparisons between projects. However agreement on a common approach to evaluation and on common measures for assessment might go a long way to meeting some of the difficulties which arise in this connection.

Issues to be Addressed in Formulating a Strategy.

It will be evident from this discussion that there are many issues to be addressed by distance educators in formulating a strategy for the evaluation

and assessment of technology-based distance education and training, and in particular for telematic networks. If the issues are to be satisfactorily resolved it is essential that we address initial questions of the following kind :

- What goals should be set and what are the priorities between these goals ? How best can these be defined in terms that are clear, specific and measurable ?
- What tasks need to be addressed, and which tasks should be accorded priority attention :
- What pedagogical issues need to be addressed ?
- What issues relating to costs, cost effectiveness, and market demand need to be addressed ?
- How can evaluation and assessment provide for the identification of critical but potentially unanticipated outcomes ?
- Is it realistic to attempt to define common indicators of input and output, for the evaluation and assessment of pedagogic and cost effectiveness, which could provide for comparability between studies ?
- What approaches should be adopted to evaluation and assessment ?

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